

1/35

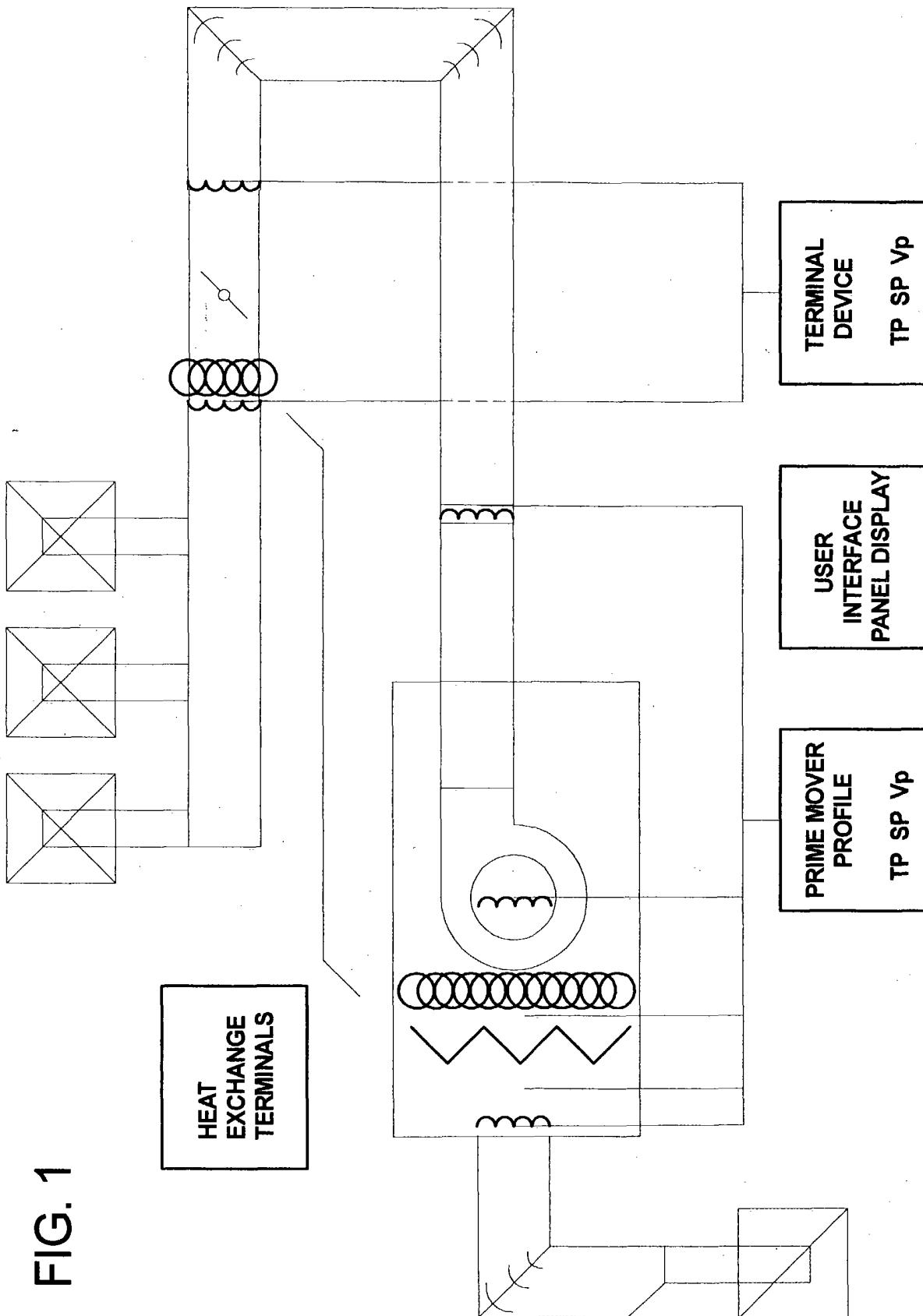


FIG. 2

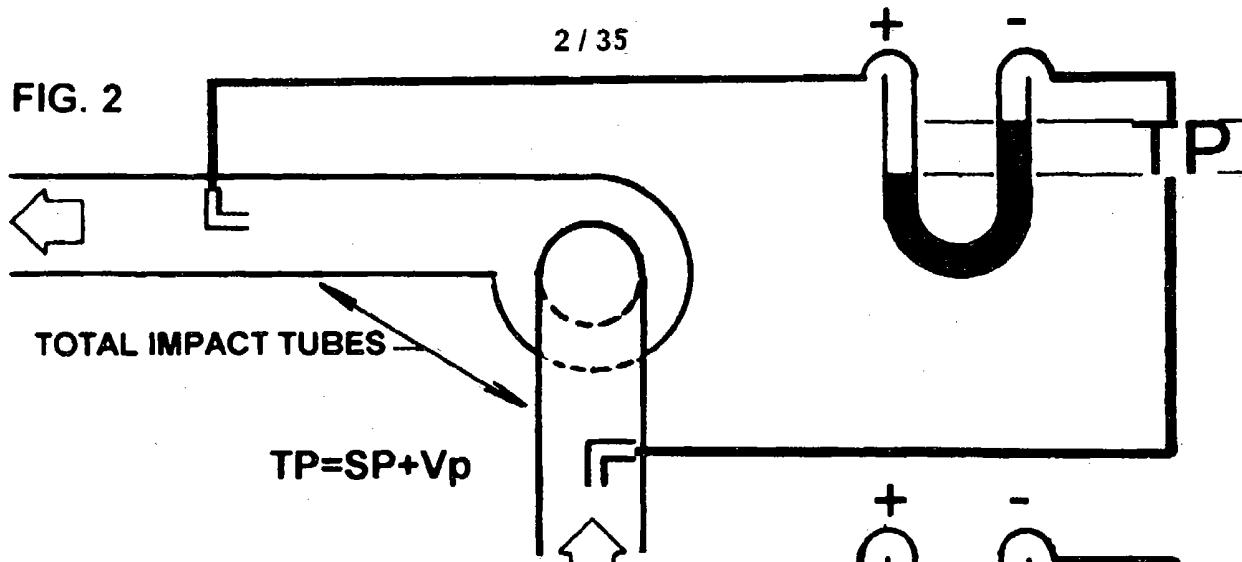


FIG. 2A

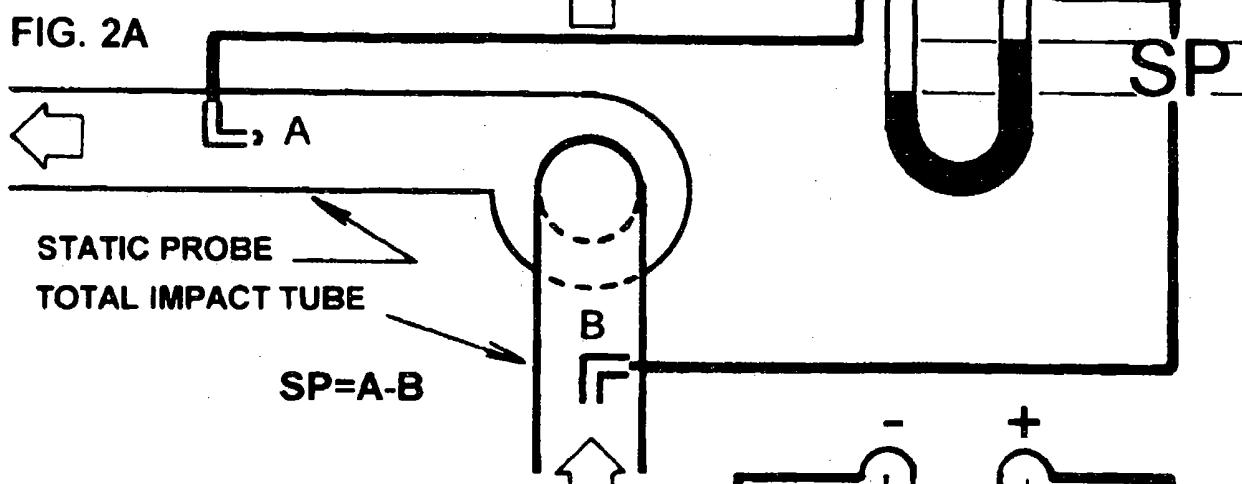


FIG. 2B

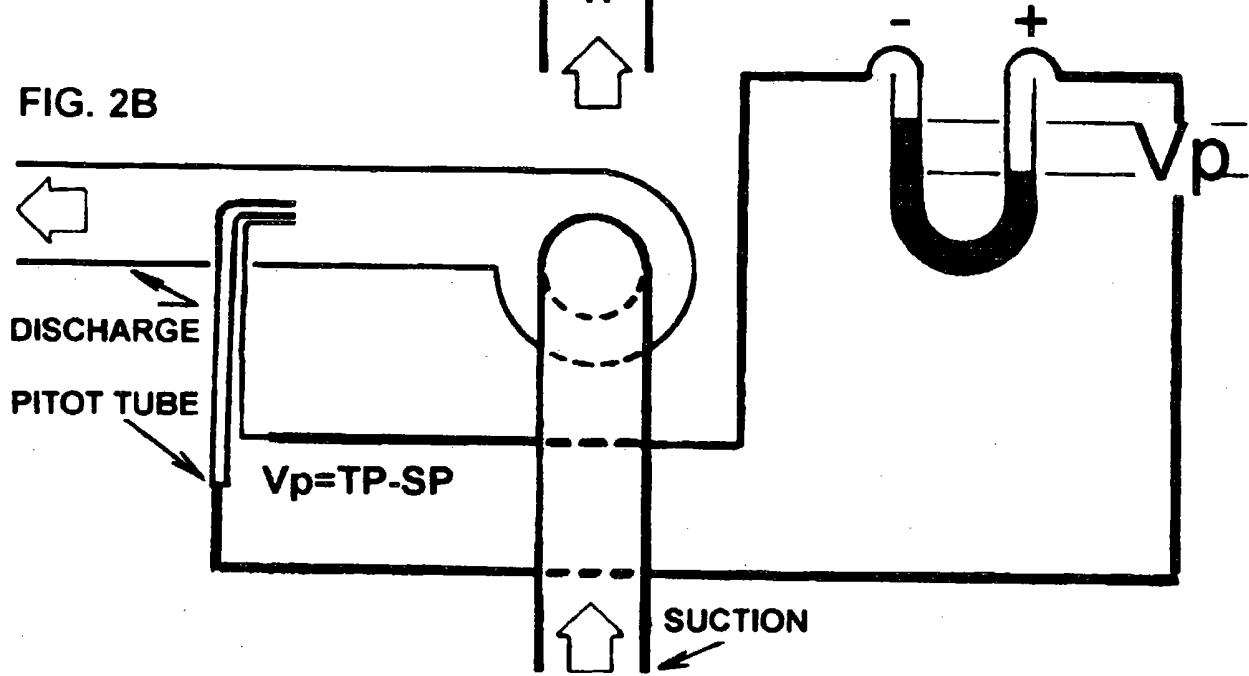


FIG. 3

TYPICAL DRAW-THRU UNIT

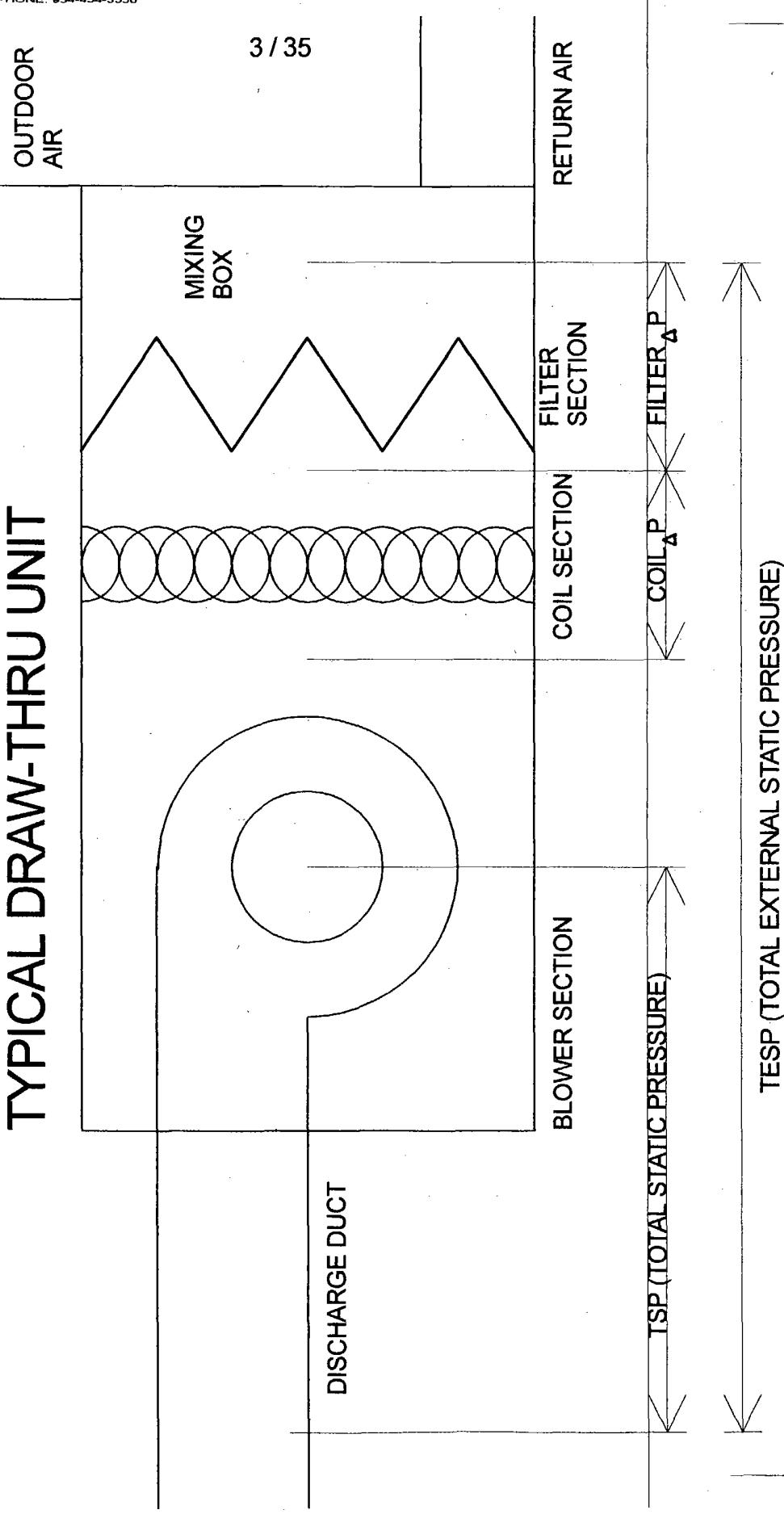


FIG. 4

NORMAL MODE OPERATION

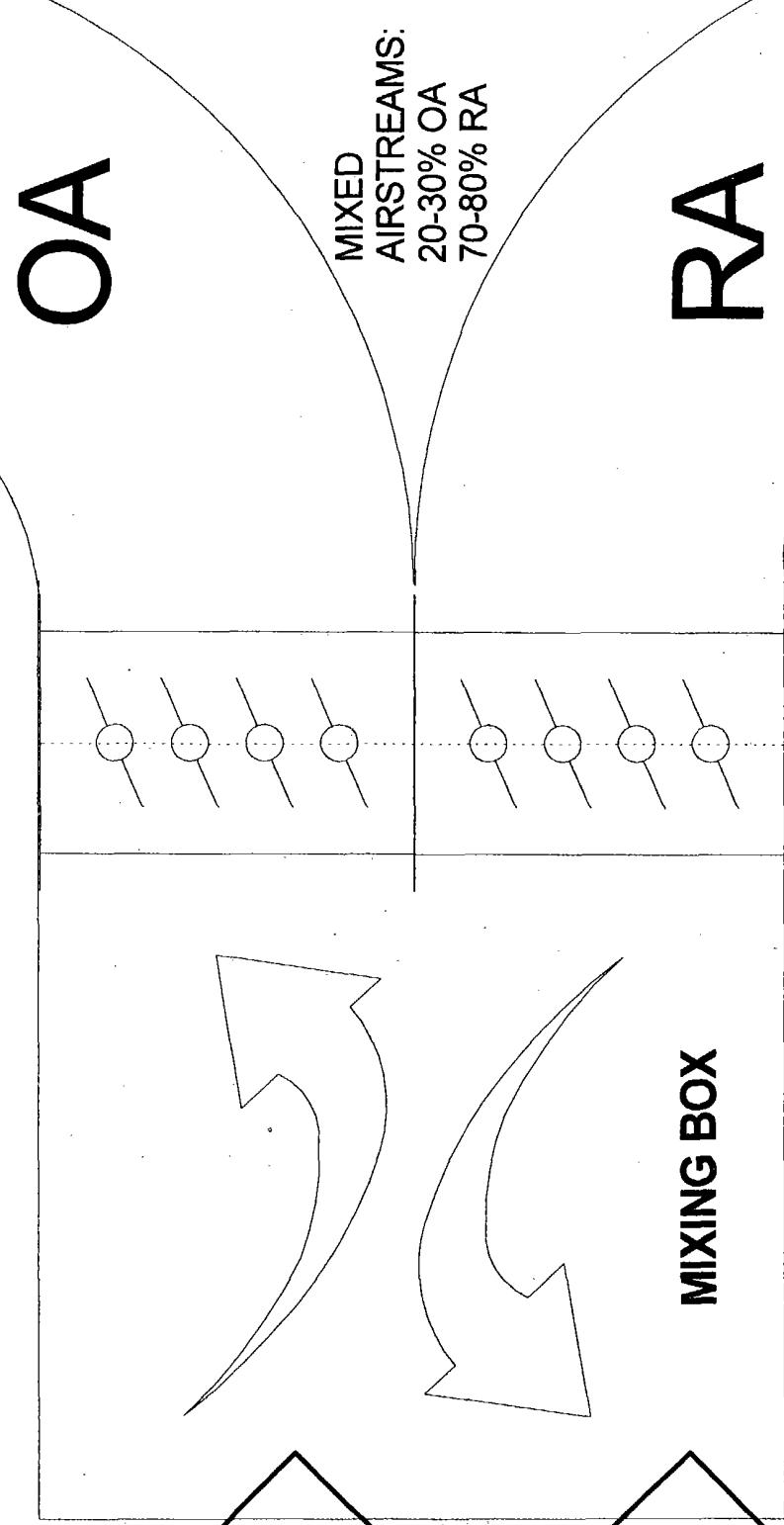
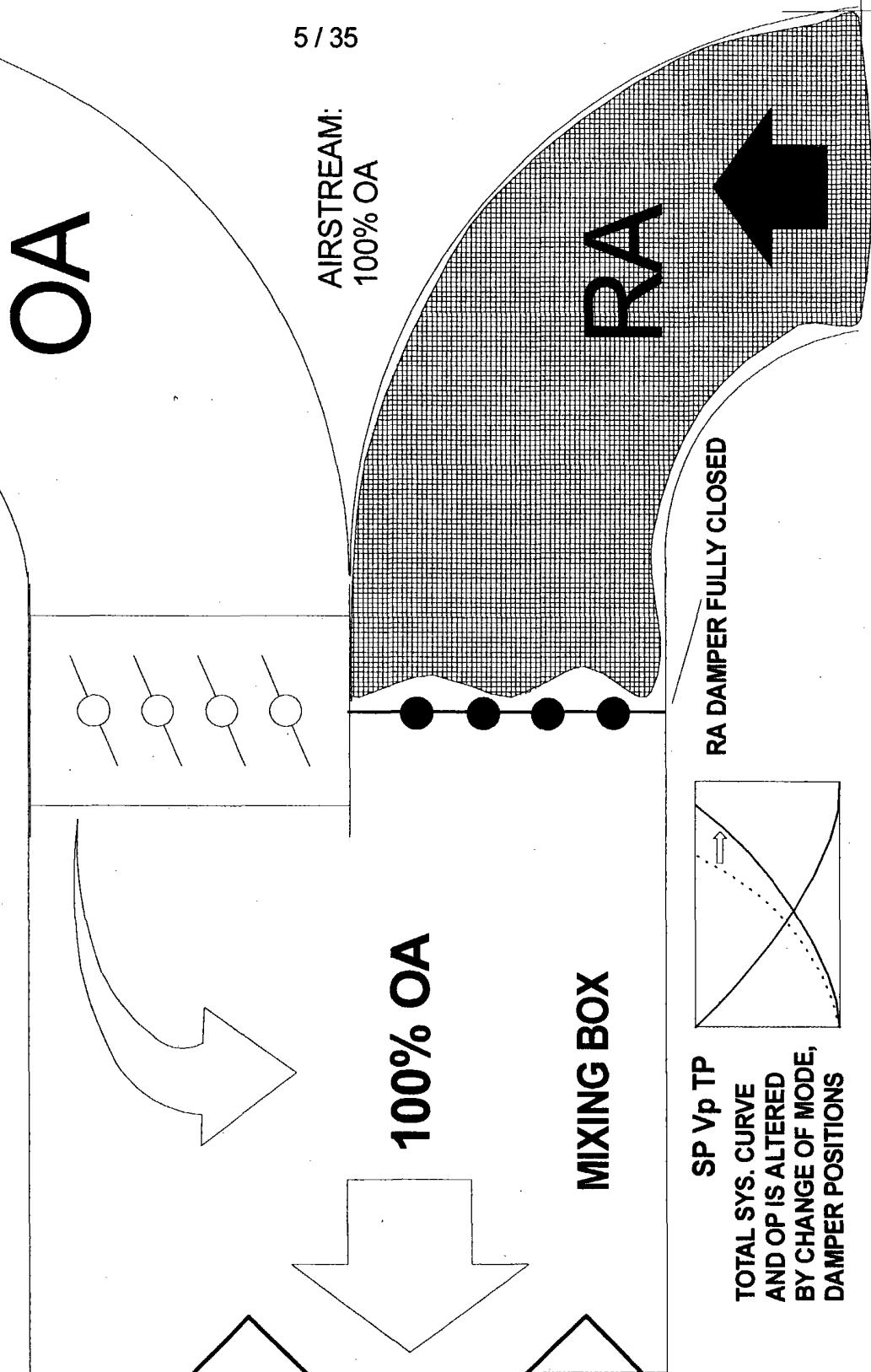


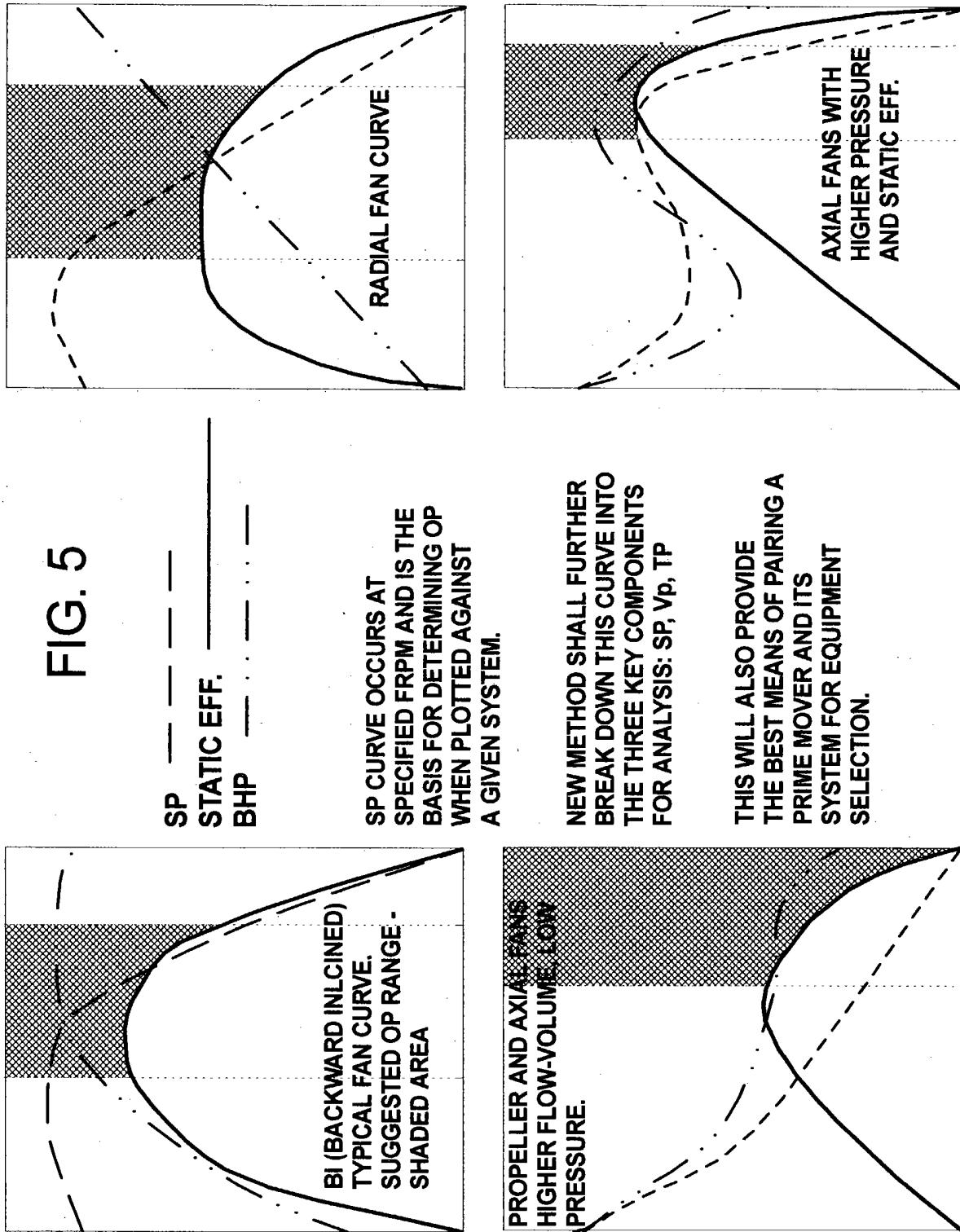
FIG. 4A

SMOKE MODE OPERATION



## TRADITIONAL FAN PERFORMANCE CURVES

FIG. 5



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METERING, AND CONTROL METHOD AND APPARATUS FOR PRIMARY MOVERS, HEAT  
EXCHANGERS, AND TERMINAL FLOW DEVICES.  
INV. NAME: DANIEL STANIMIROVIC  
PHONE: 954-454-3550

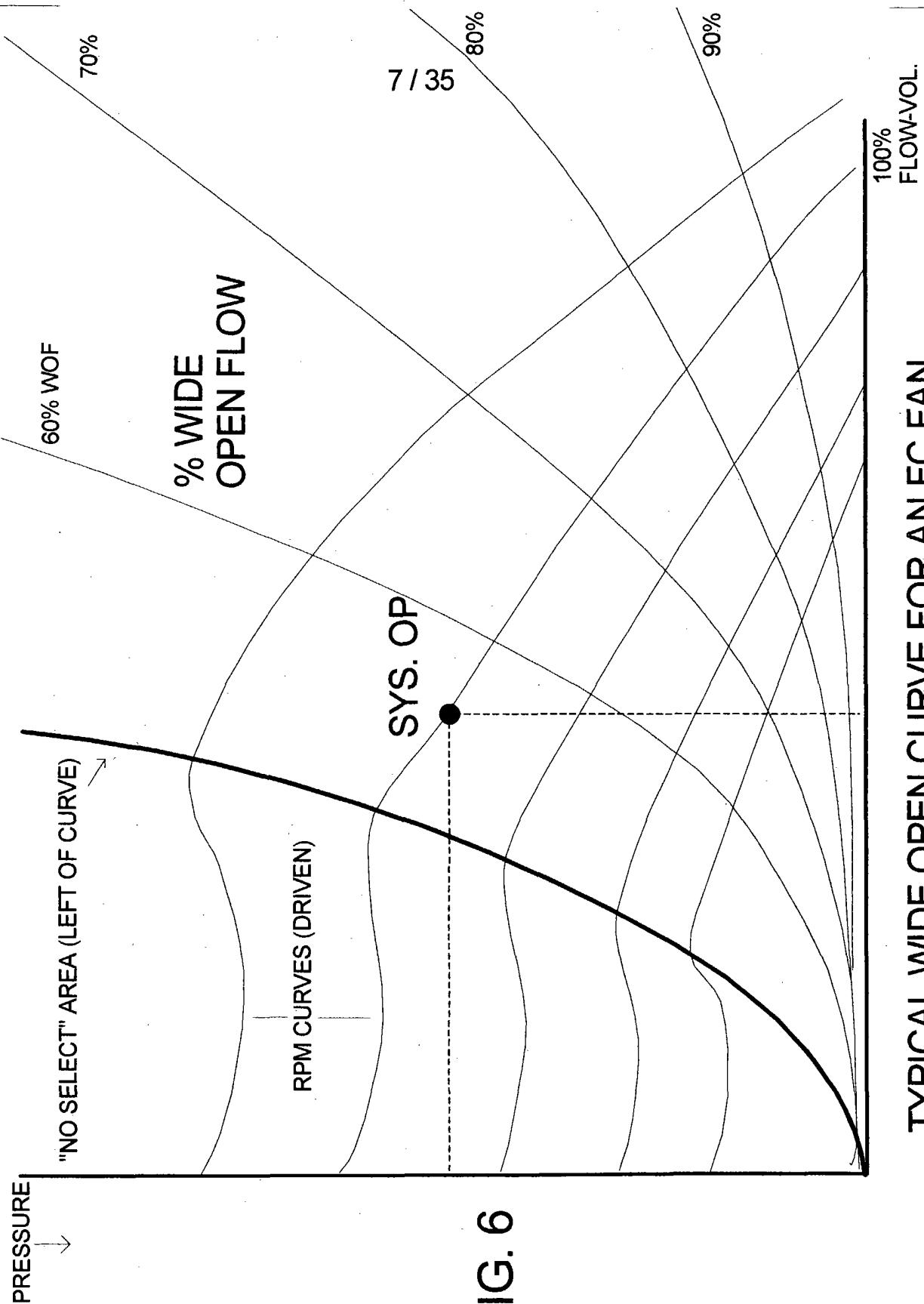
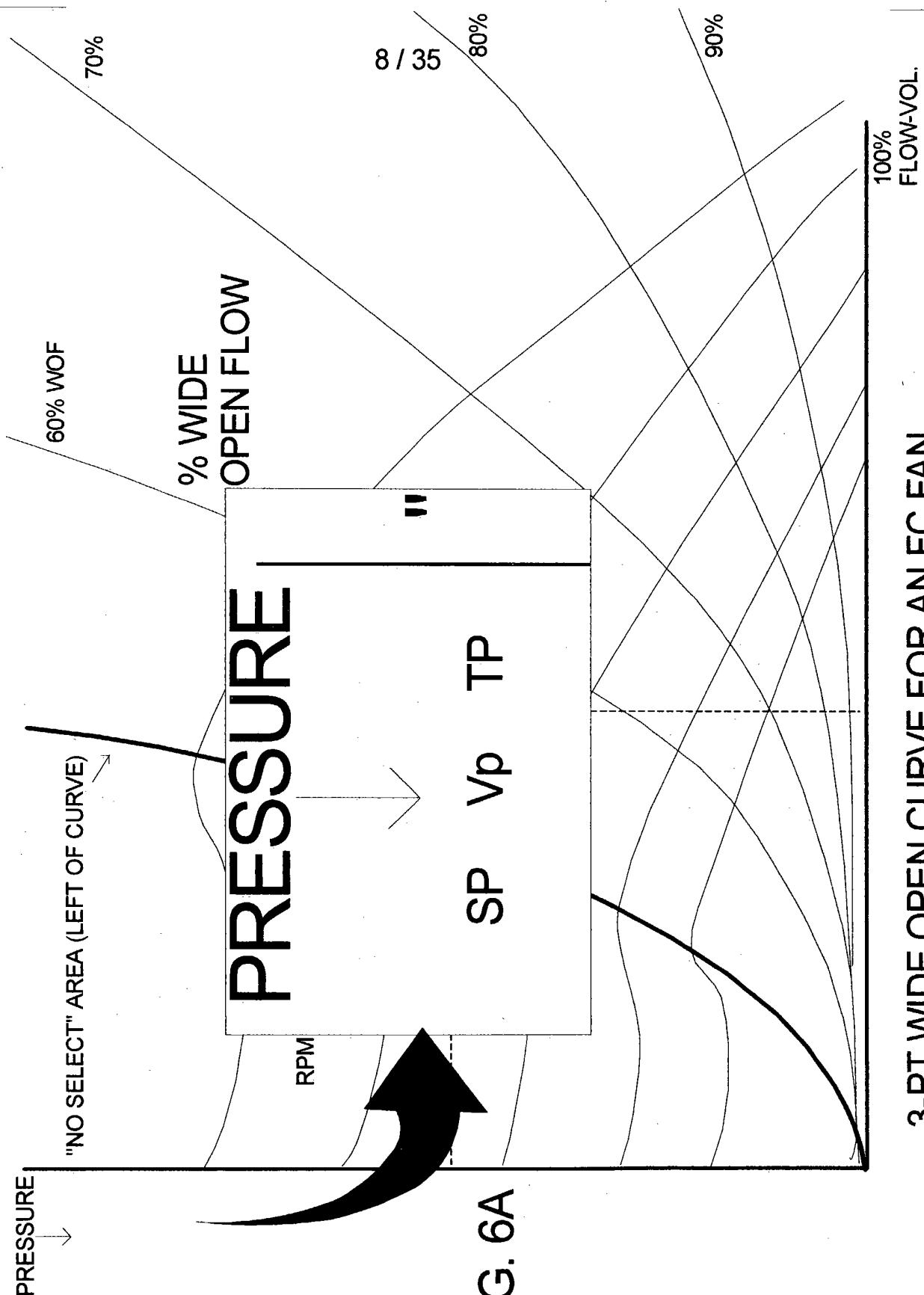


FIG. 6

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INV. NAME: DANIEL STANIĆMIROVIĆ

INV. NAME: DANIEL STANIMIROVIC  
PHONE: 954-454-3550

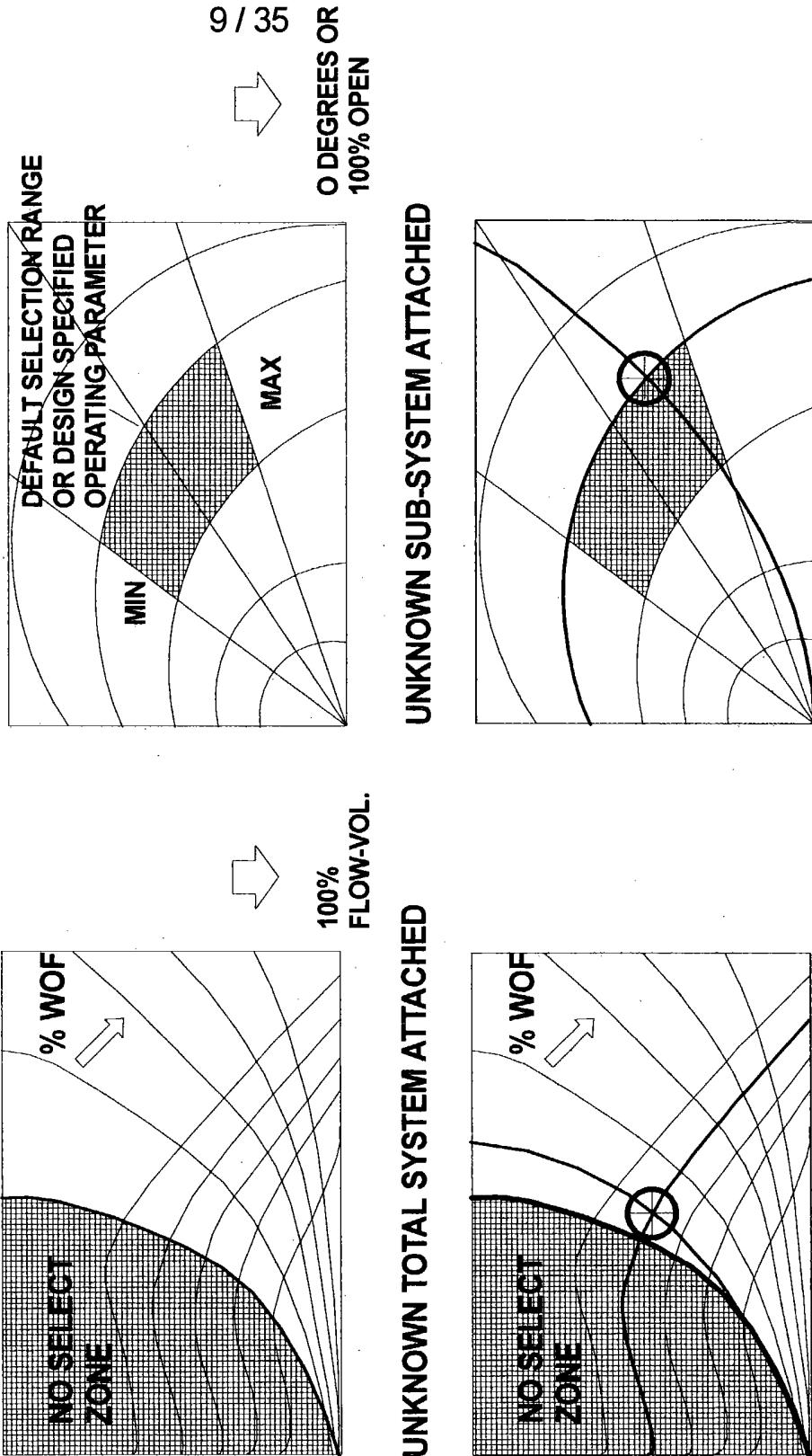


## 3-PT WIDE OPEN CURVE FOR AN FC FAN

FIG. 6A

## WIDE OPEN AND SYSTEM CURVES JUXTAPOSED

**FIG. 7A**  
TERMINAL OR IN-LINE DEVICE WOC



## PRIMARY OR TERMINAL HEAT EXCHANGE

**FIG. 8**  
AIR TO WATER

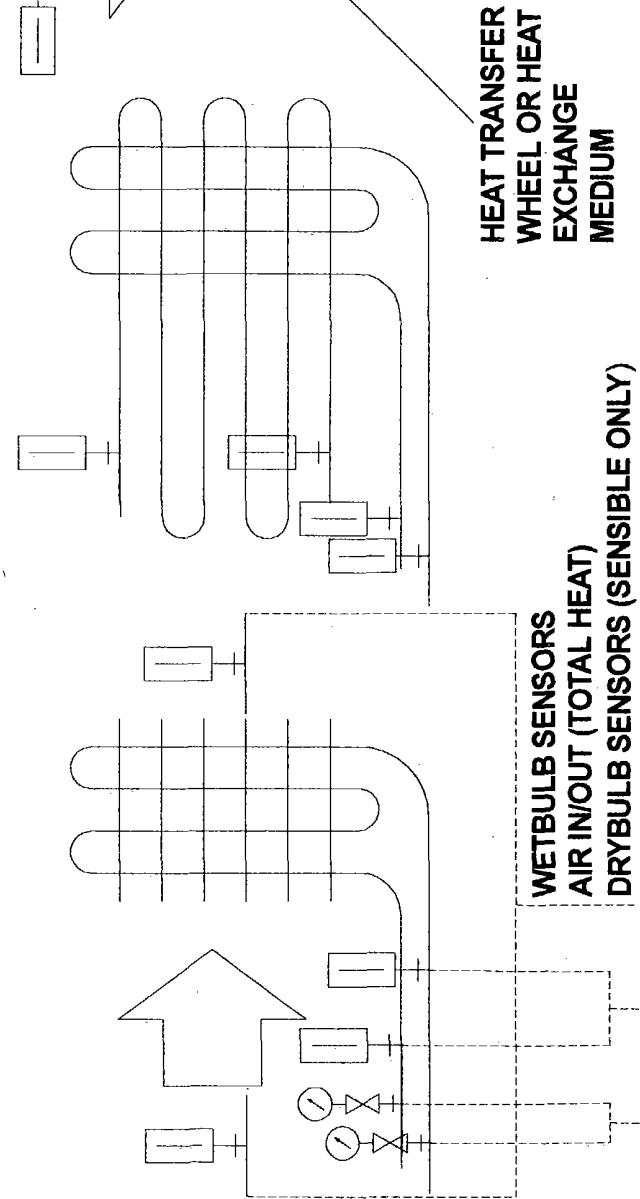
**FIG. 8A**  
WATER TO WATER

**FIG. 8B**  
AIR TO AIR

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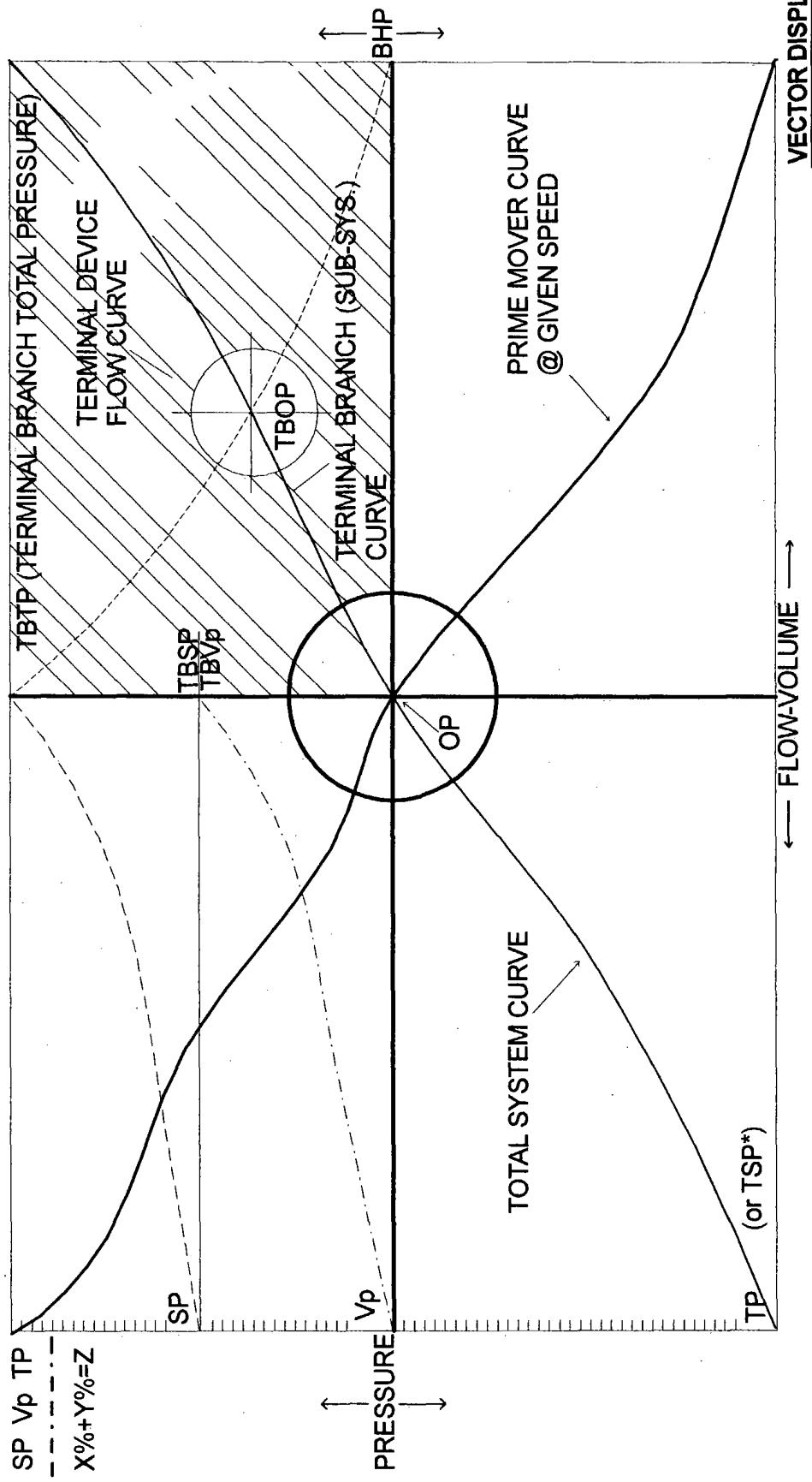


ENTERING AND LEAVING AIR  
TEMPERATURES IN COUNTER  
FLOW EXCHANGER

\*VARIATIONS WOULD INCLUDE THE  
FOLLOWING IN ANY ARRANGEMENT,  
FORM, NUMBER, OR COMBINATION:

FIG. 9

MAIN PANEL DISPLAY



\*TOTAL STATIC PRESSURE AS WITH TRADITIONAL PERFORMANCE CURVES, WHERE TP=SP  
OP - OPERATING POINT (CENTER)

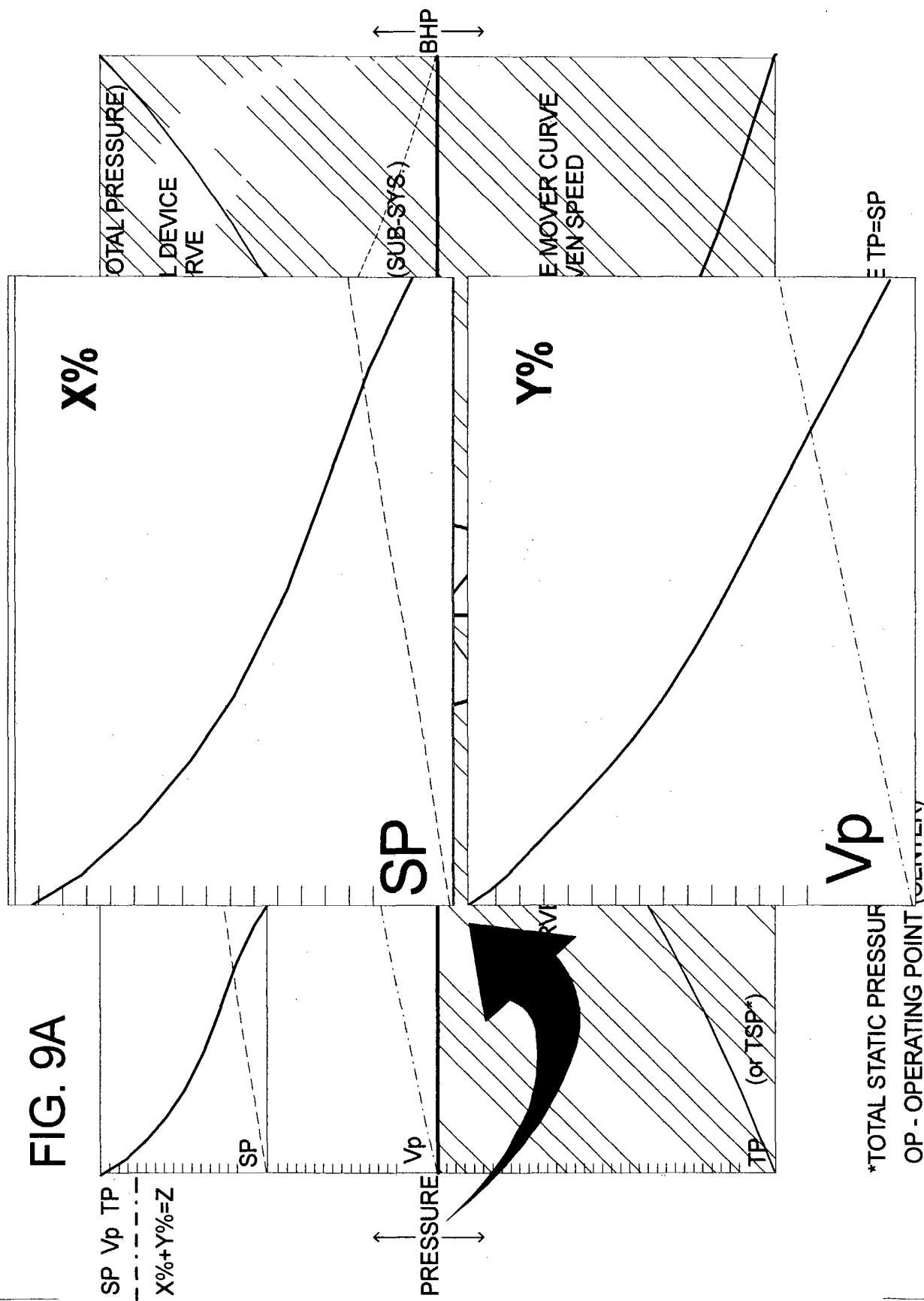
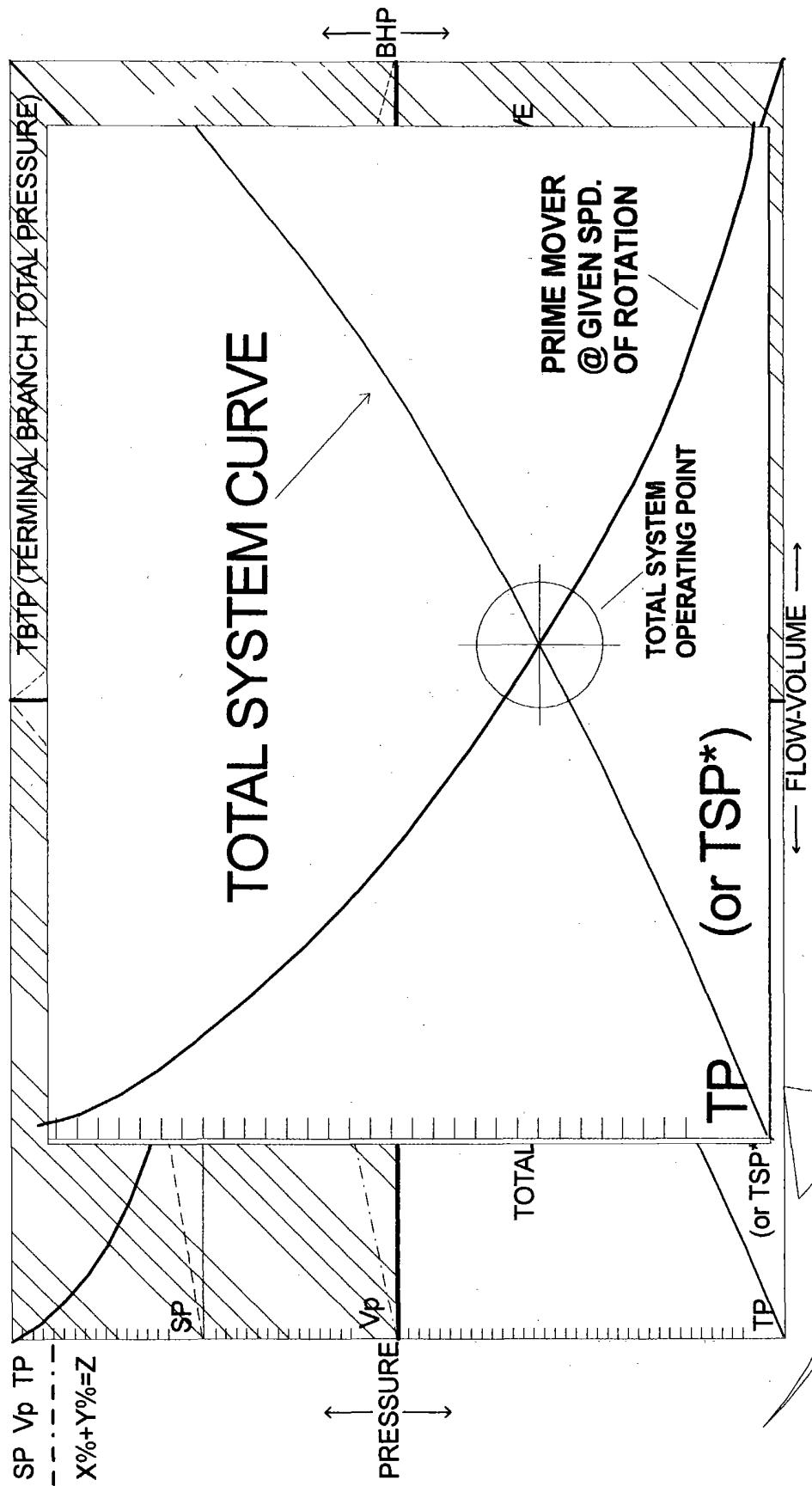
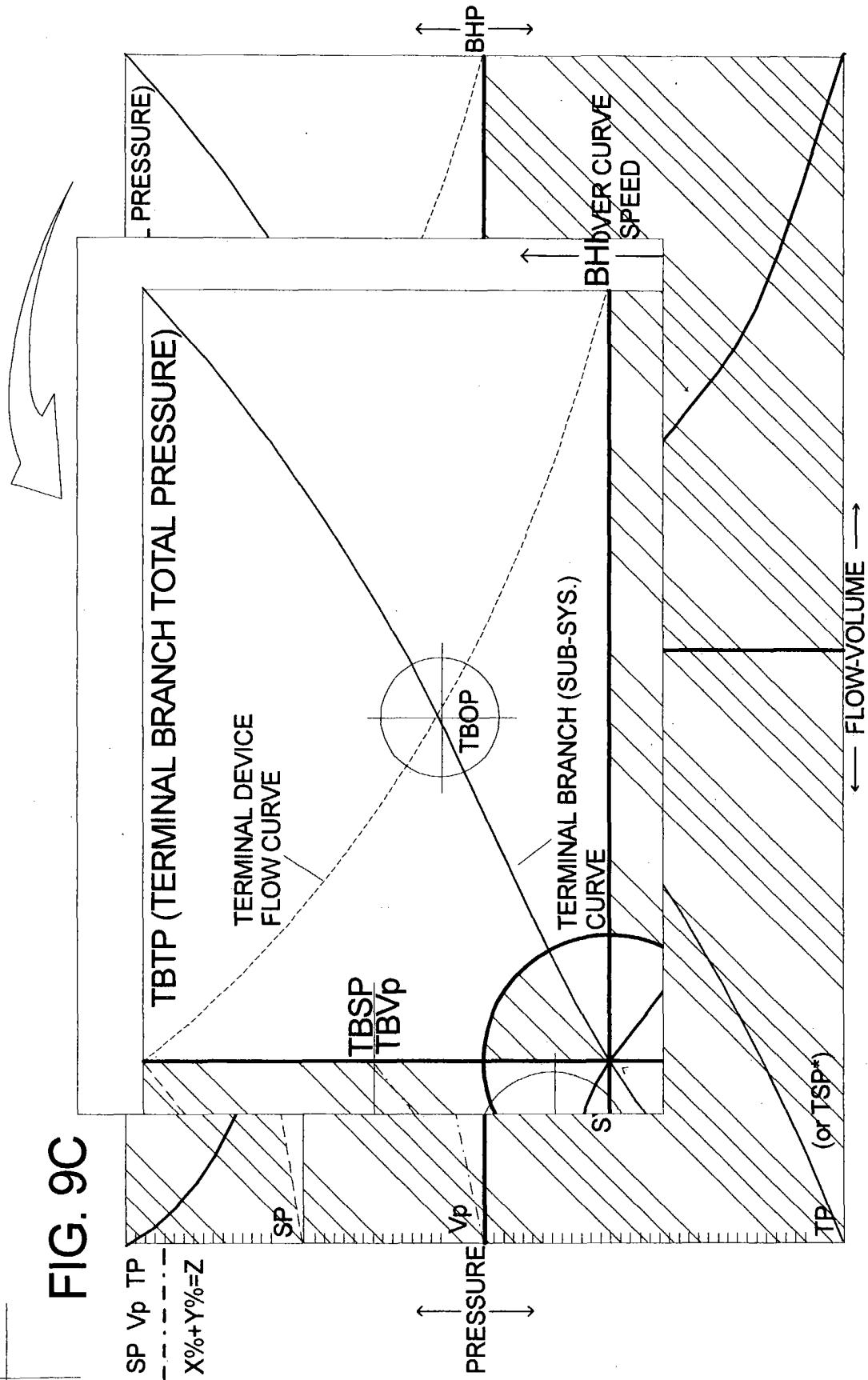


FIG. 9B

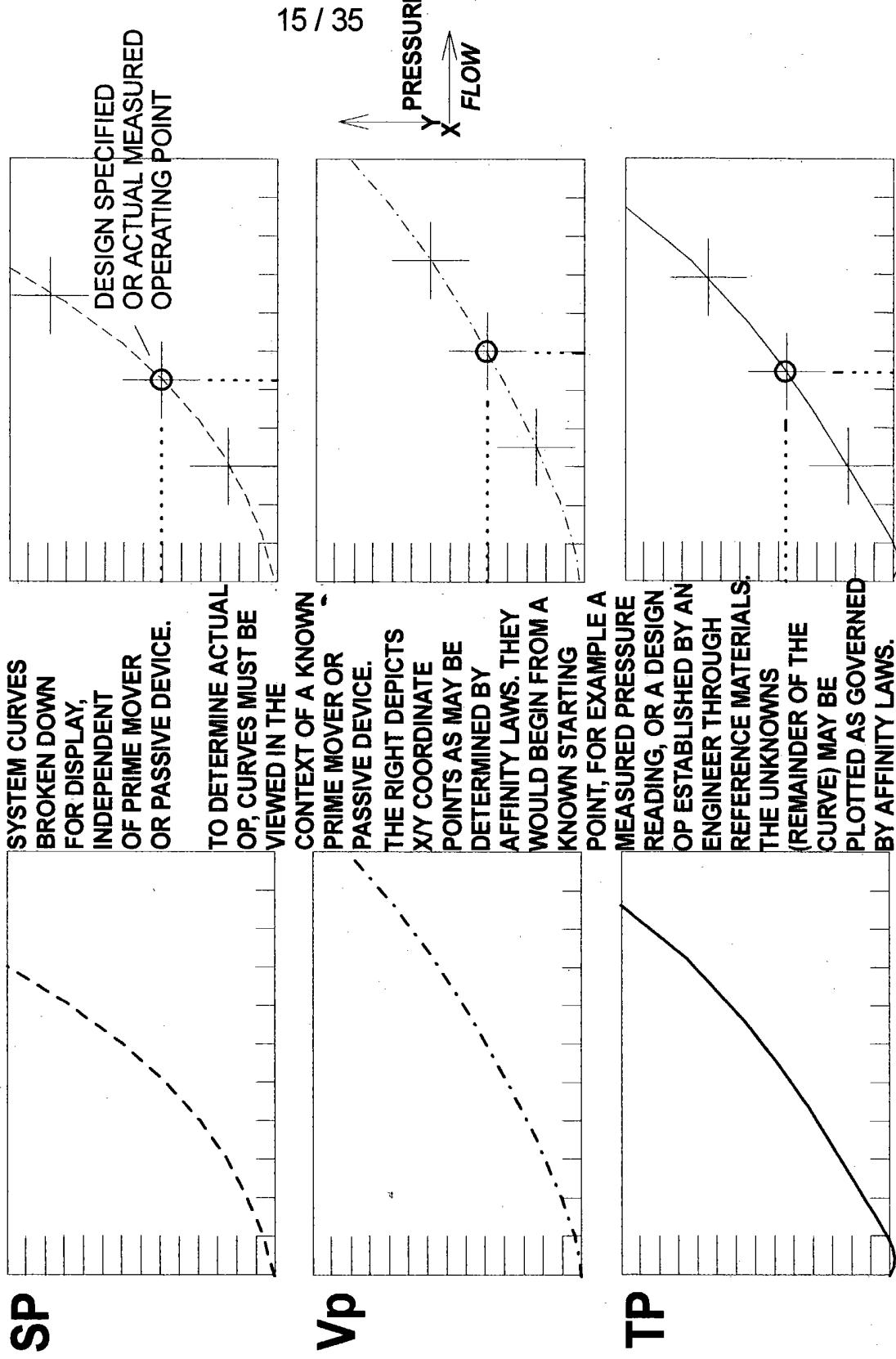


\*TOTAL STATIC PRESSURE AS WITH TRADITIONAL PERFORMANCE CURVES, WHERE TP=SP  
OP - OPERATING POINT (CENTER)



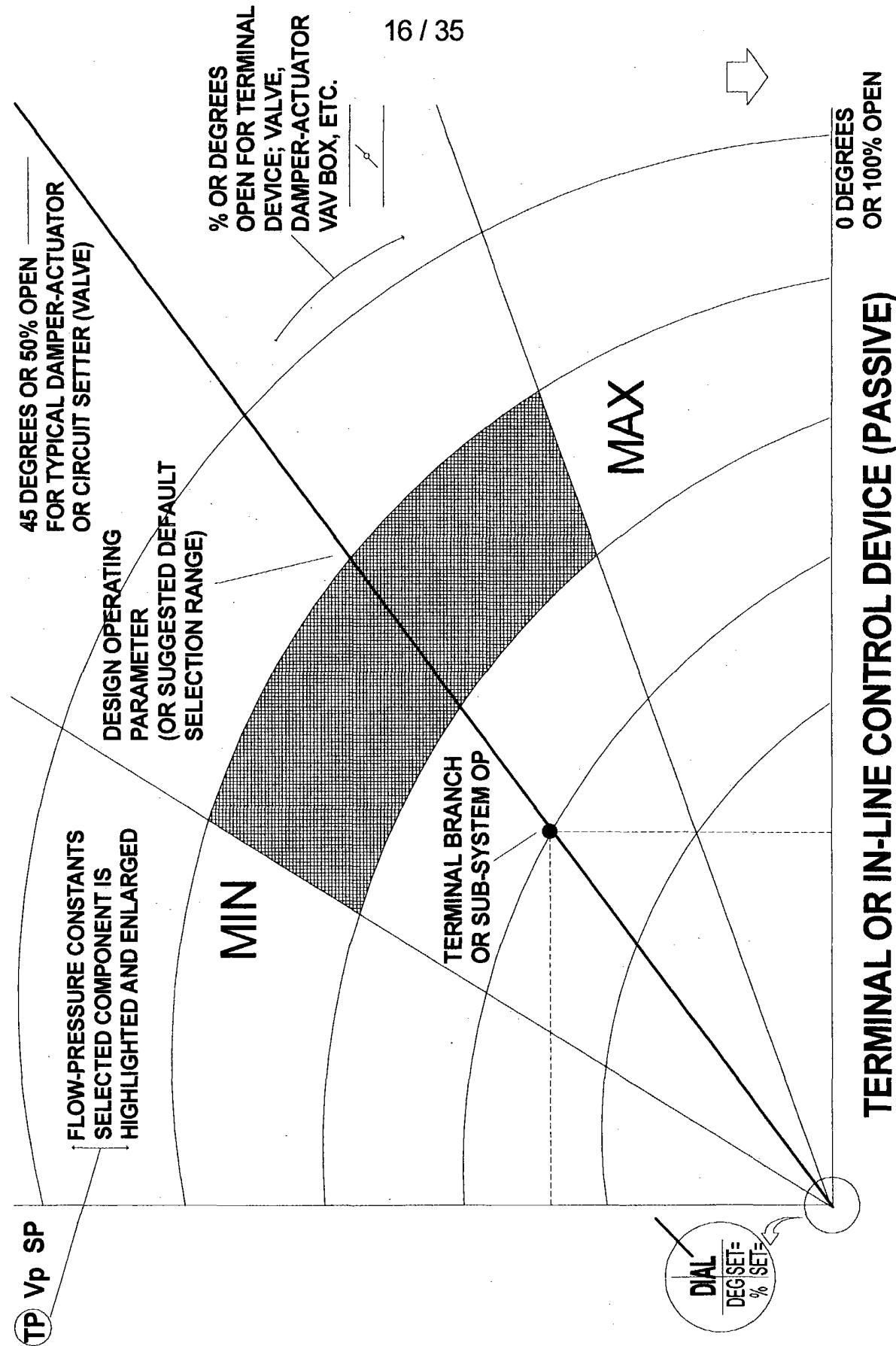
\*TOTAL STATIC PRESSURE AS WITH TRADITIONAL PERFORMANCE CURVES, WHERE  $TP=SP$   
OP - OPERATING POINT (CENTER)

## FIG. 10 3-PART SYSTEM CURVES VIEWED INDEPENDENTLY



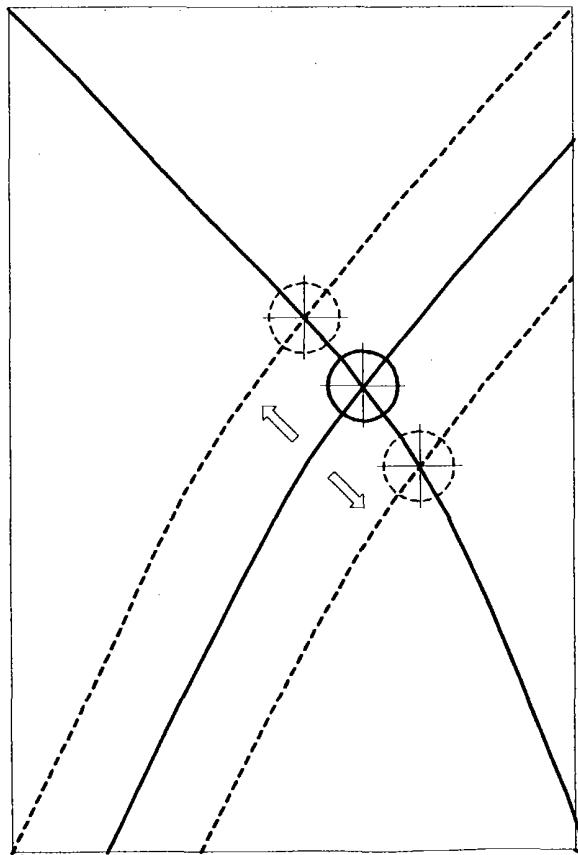
## TERMINAL DEVICE (WOC) WIDE OPEN CURVE

FIG. 11



## CURVE RIDING AND OP DEVIATION

FIG. 12



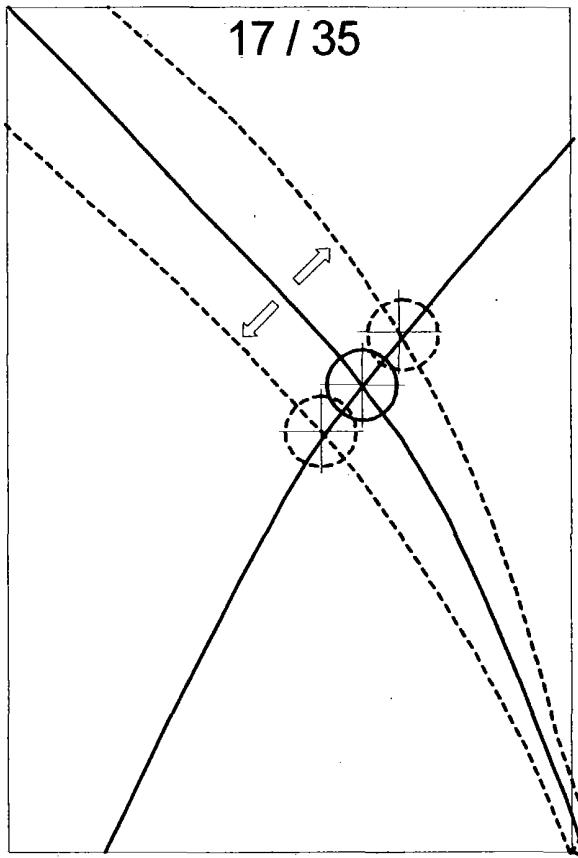
## PRIME MOVER CHANGES

ROTATIONAL SPEED

SECONDARY MOVER

SERIES OR PARALLEL  
OPERATION

FIG. 12A



## SYSTEM CHANGES

TP SP V<sub>p</sub>

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INV. NAME: DANIEL STANIMIROVIC

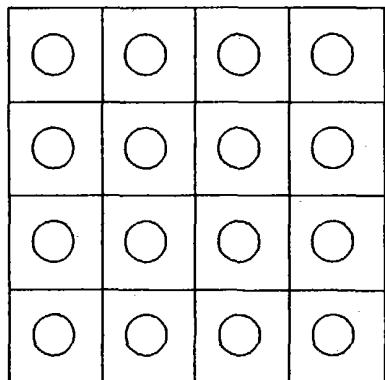
PHONE: 954-454-3550

FIG. 13

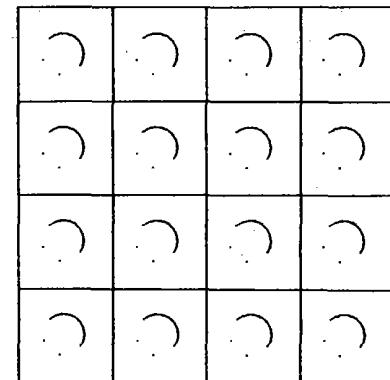
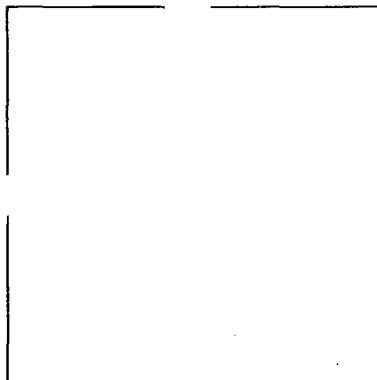
SENSOR LOGIC



DUCT CROSS-SECTIONAL EQUAL AREA TRAVERSE



TOTAL IMPACT SENSORS



VELOCITY ONLY SENSORS  
TP-SP, AS WITH PITOT TUBE

## PRIME MOVER SENSOR LOGIC

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FIG. 14

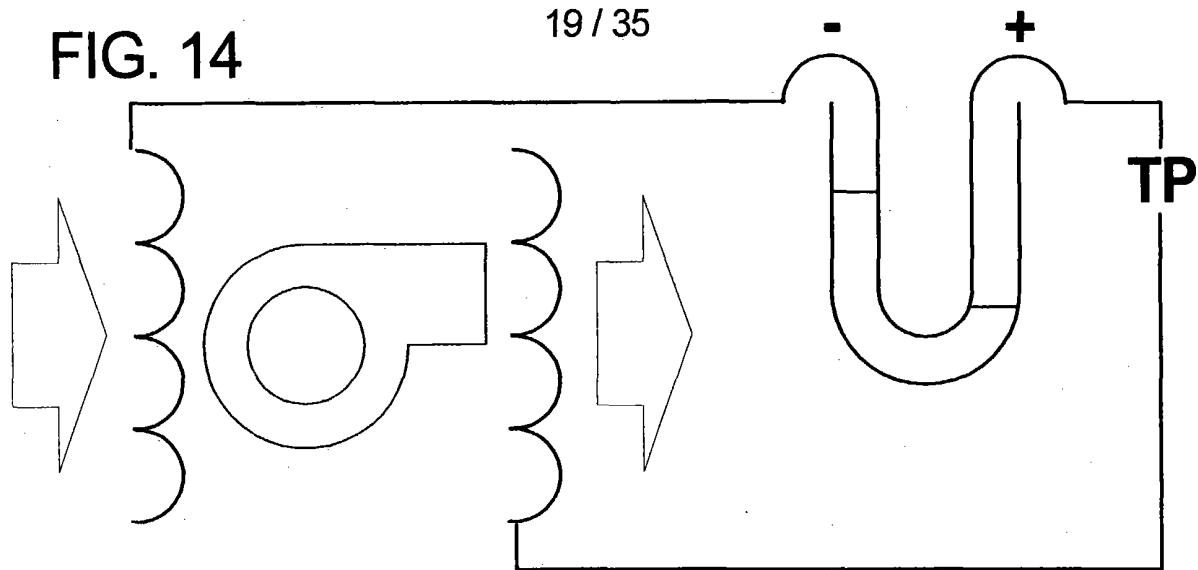


FIG. 14A

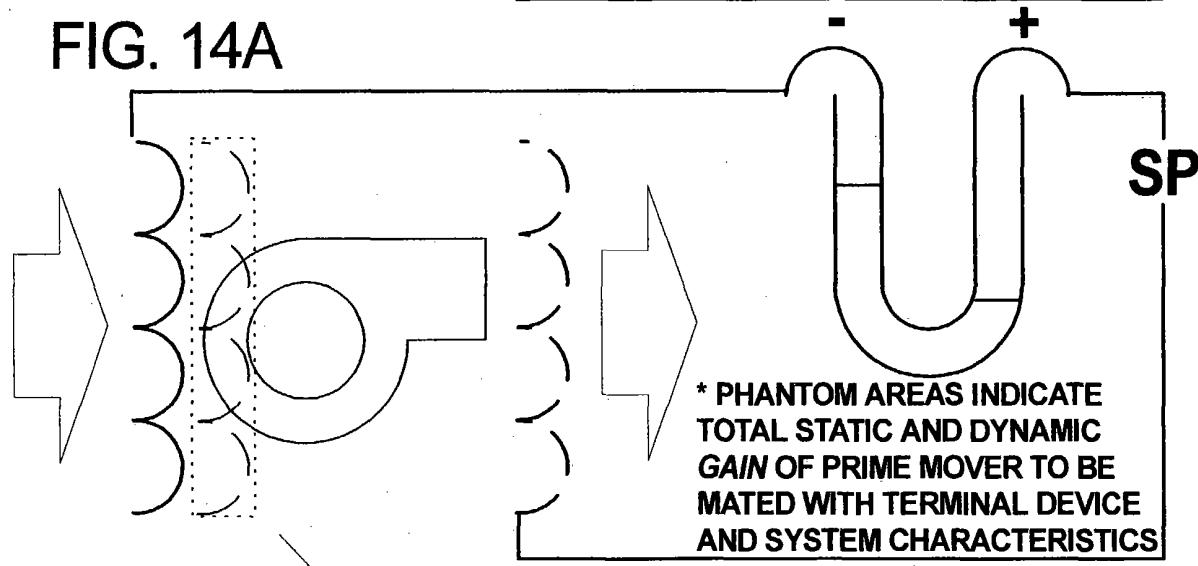
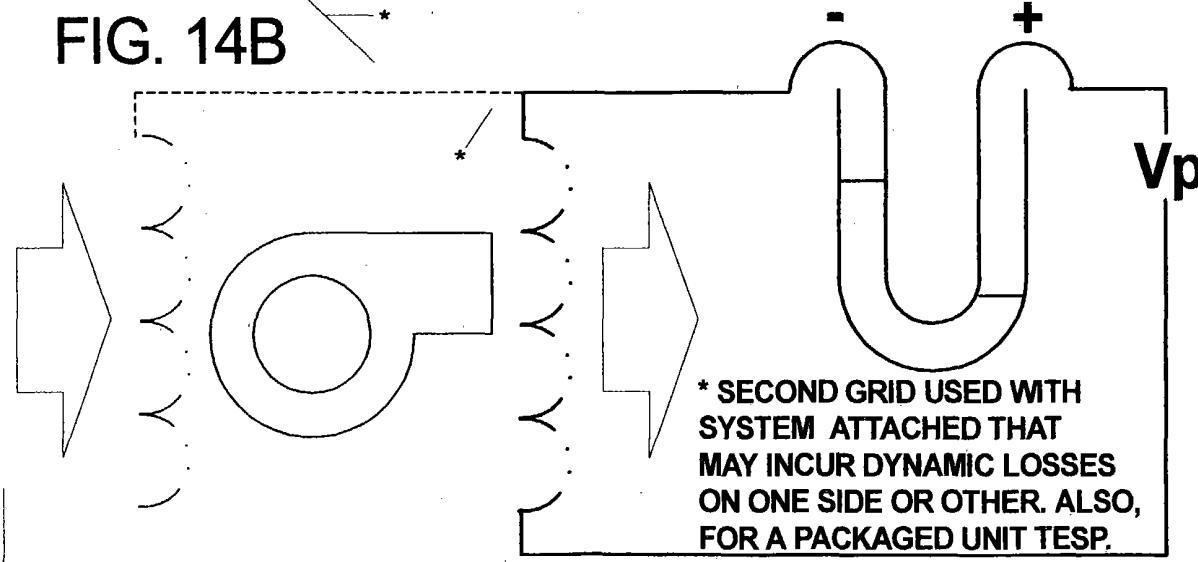


FIG. 14B

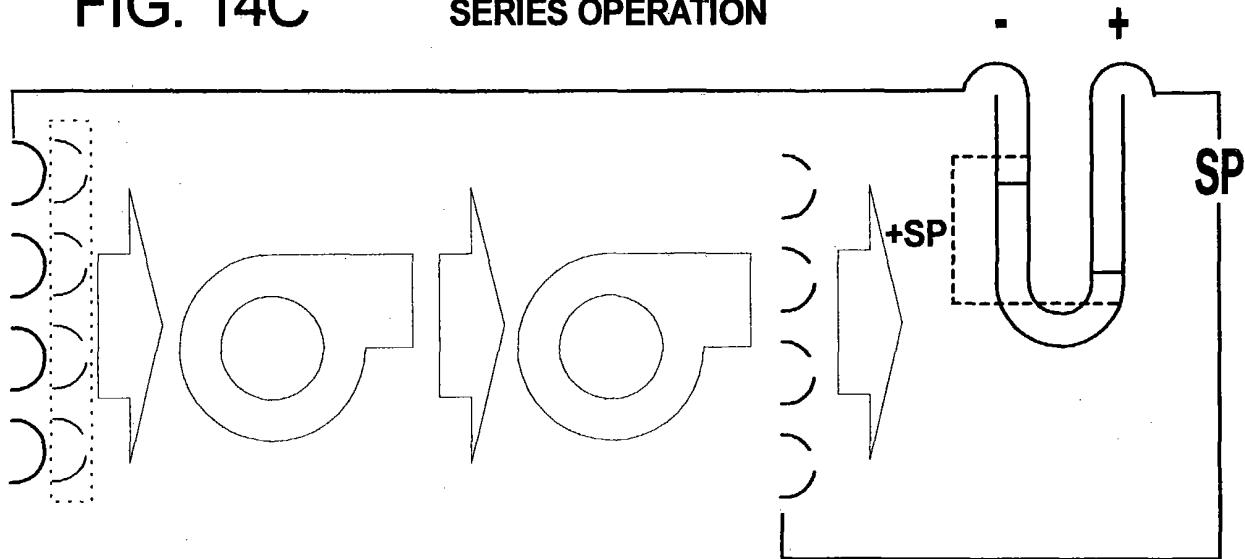


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## MOVER SENSOR LOGIC IN SERIES OR PARALLEL OPERATION

FIG. 14C

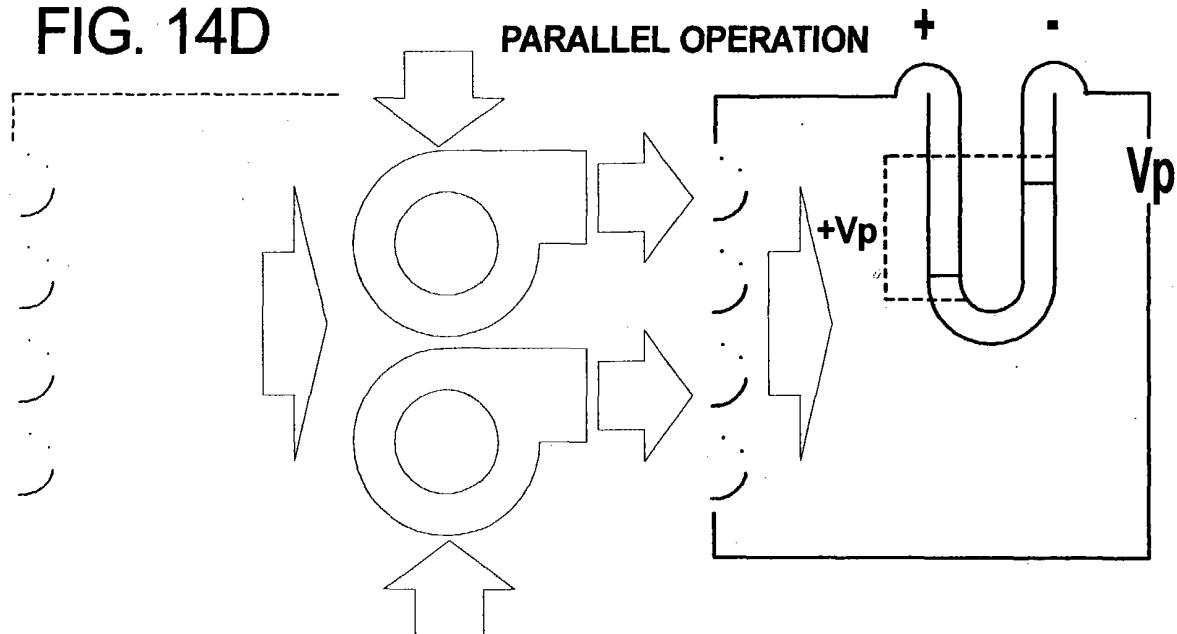
SERIES OPERATION



ONE OR MORE PRIMARY MOVERS IN SERIES OR PARALLEL  
AUGMENT EITHER SP OR Vp, RESPECTIVELY, AS SHOWN.

FIG. 14D

PARALLEL OPERATION



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## TERMINAL DEVICE FIG. 15 SENSOR LOGIC

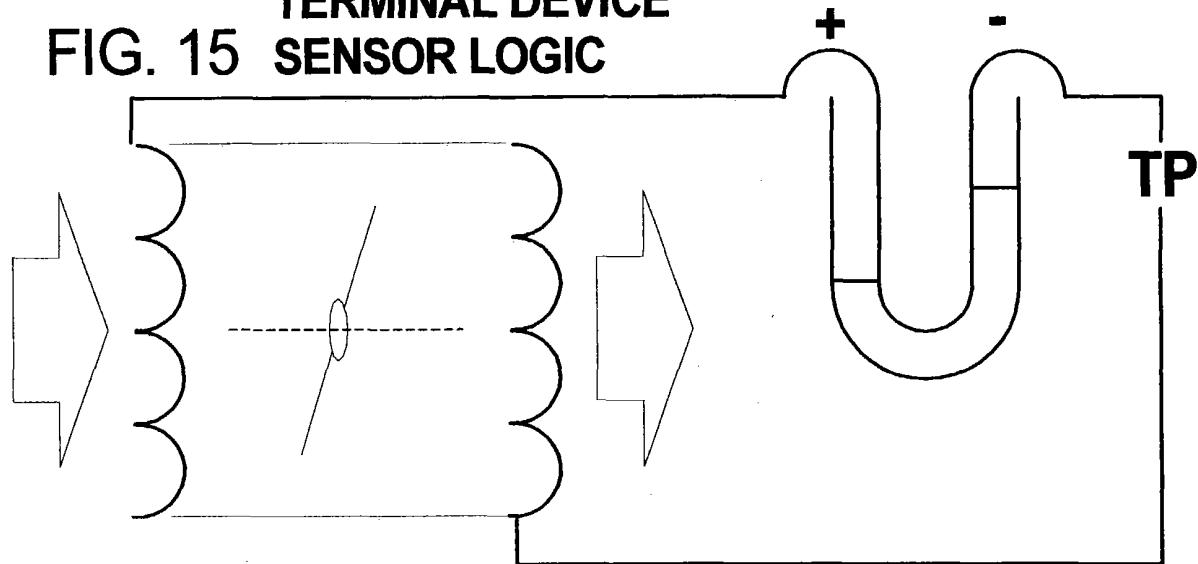


FIG. 15A

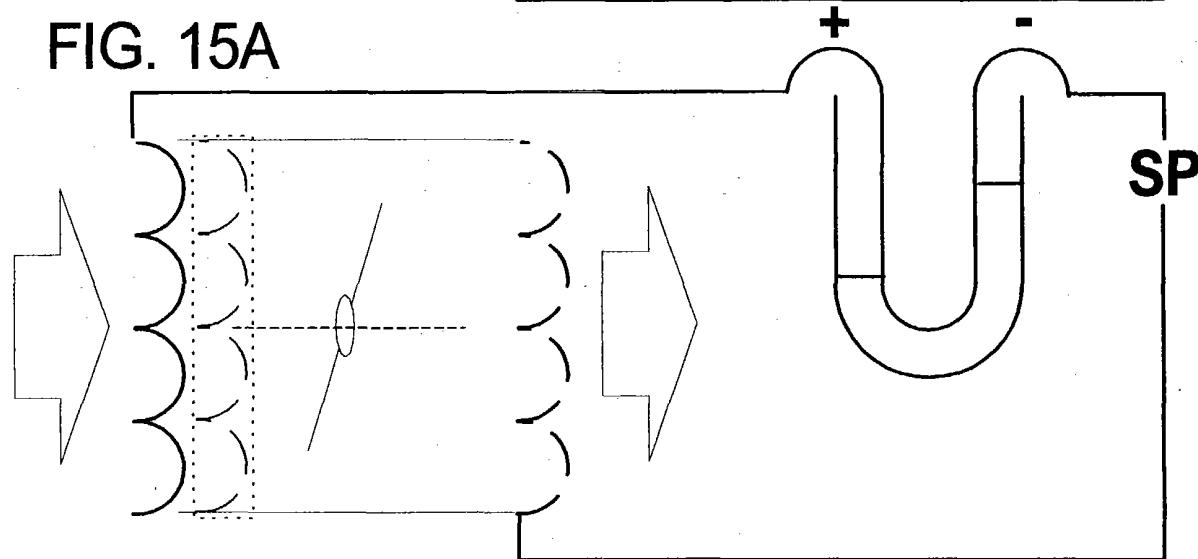
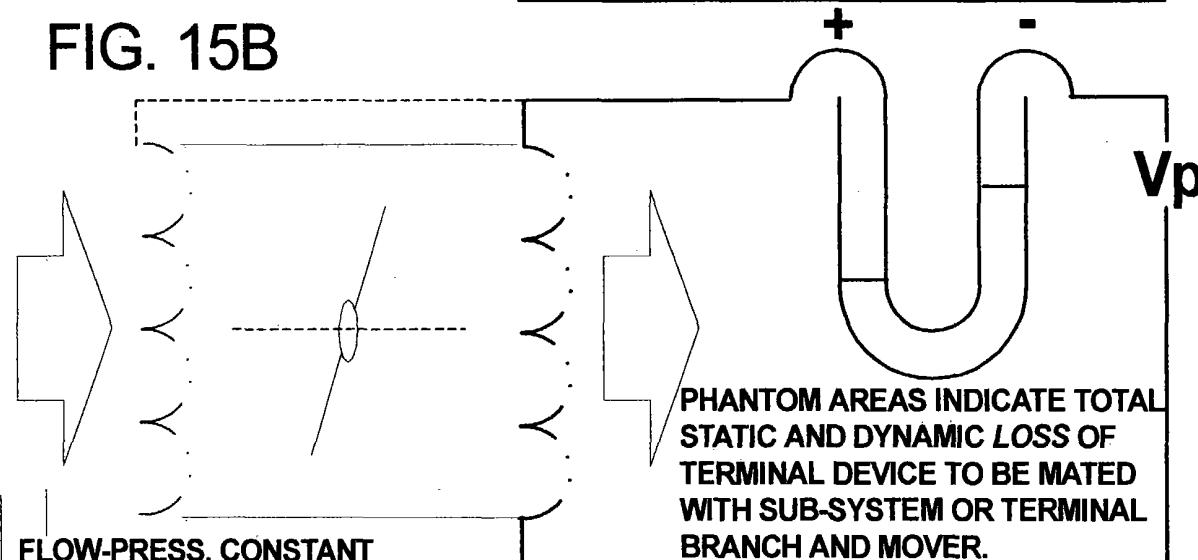
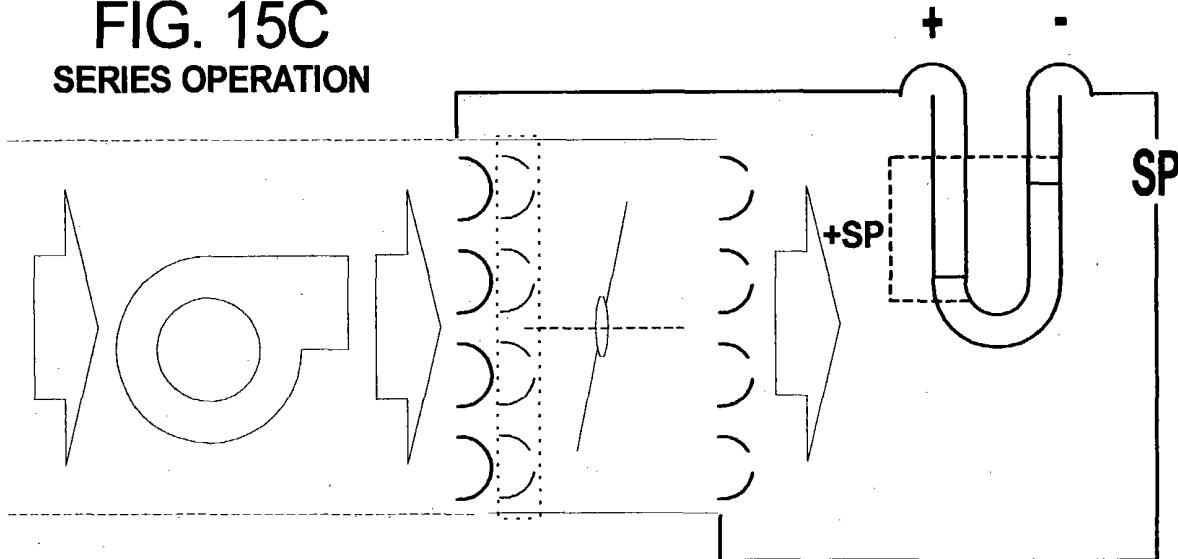


FIG. 15B



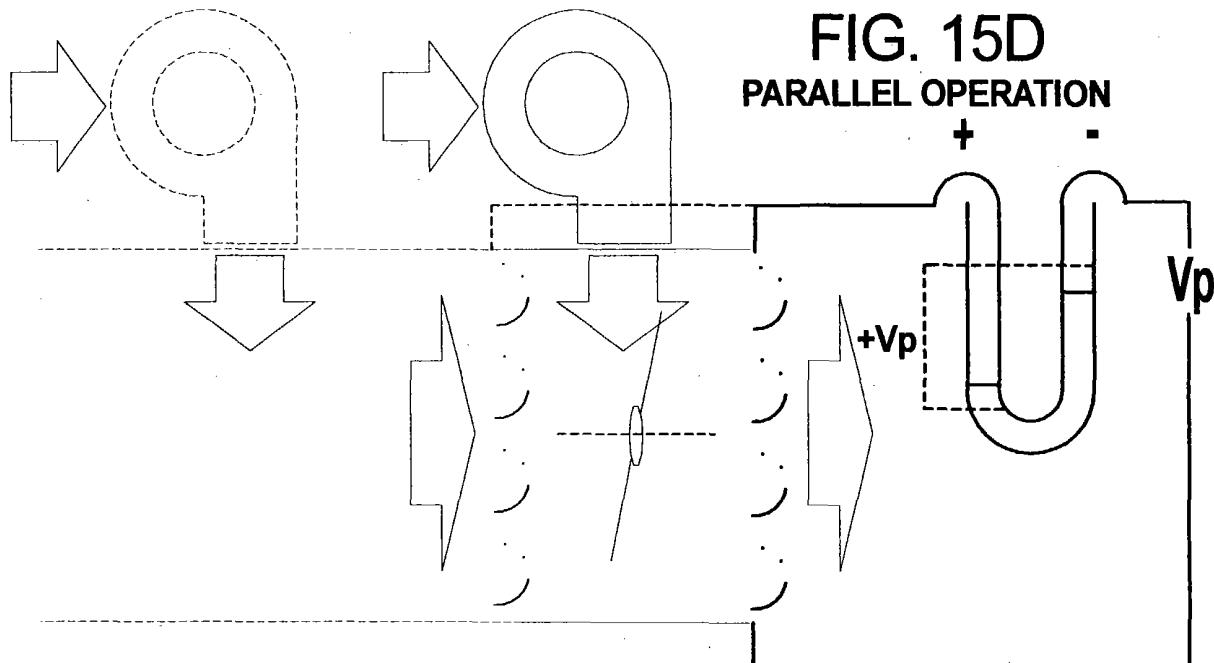
## TERMINAL DEVICE SENSOR LOGIC WITH SECONDARY MOVER

**FIG. 15C**  
SERIES OPERATION



ONE OR MORE SECONDARY MOVERS IN SERIES OR PARALLEL  
AUGMENT EITHER SP OR Vp, RESPECTIVELY, AS SHOWN.

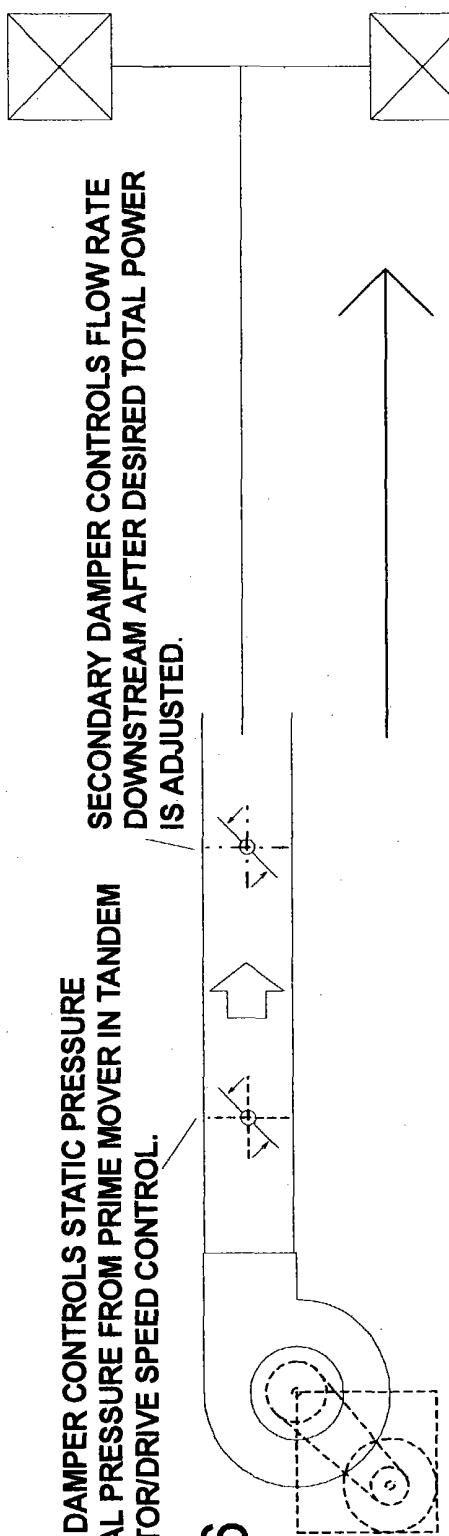
**FIG. 15D**  
PARALLEL OPERATION



## DUAL DAMPER CONTROL IN SERIES AND PARALLEL

PRIMARY DAMPER CONTROLS STATIC PRESSURE  
AND TOTAL PRESSURE FROM PRIME MOVER IN TANDEM  
WITH MOTOR/DRIVE SPEED CONTROL.

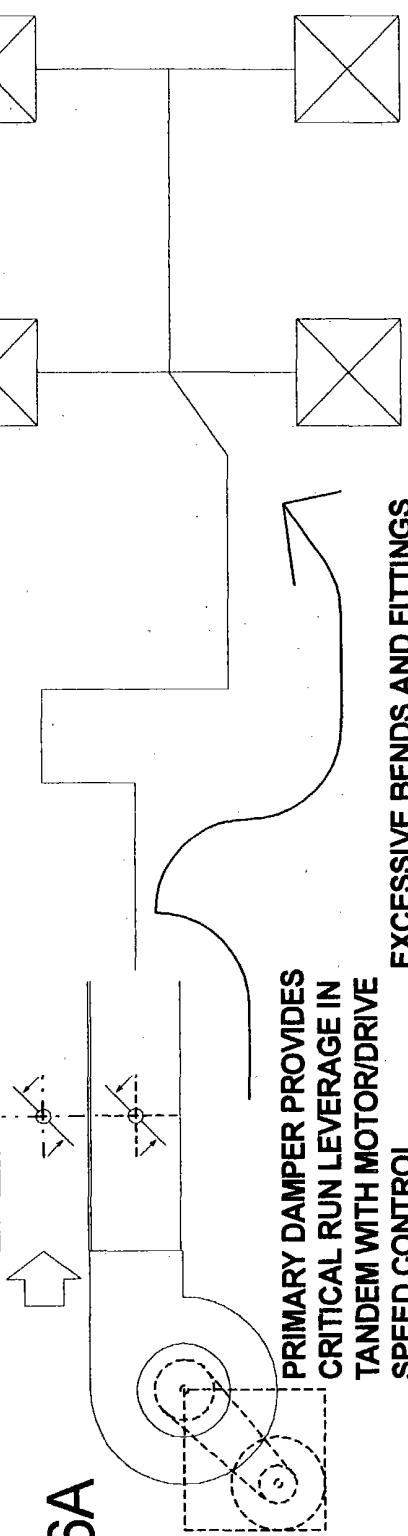
FIG. 16



PARALLEL DAMPER AND FLOW SOURCE PROVIDES CUMULATIVE VELOCITY TO TRAVERSE FITTING AND DIRECTIONAL LOSSES

LONG RUNS, MINIMAL FITTINGS

FIG. 16A



## LEAKAGE TESTER

SP LEVEL ADJUSTED TO  
DUCTWORK RATING TO  
PERFORM STANDARD  
TEST FOR GIVEN SECTION

Vp

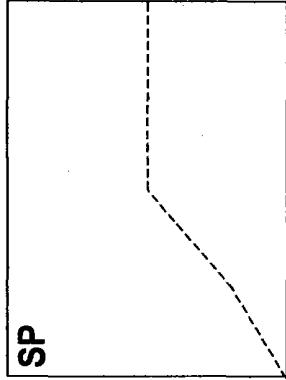


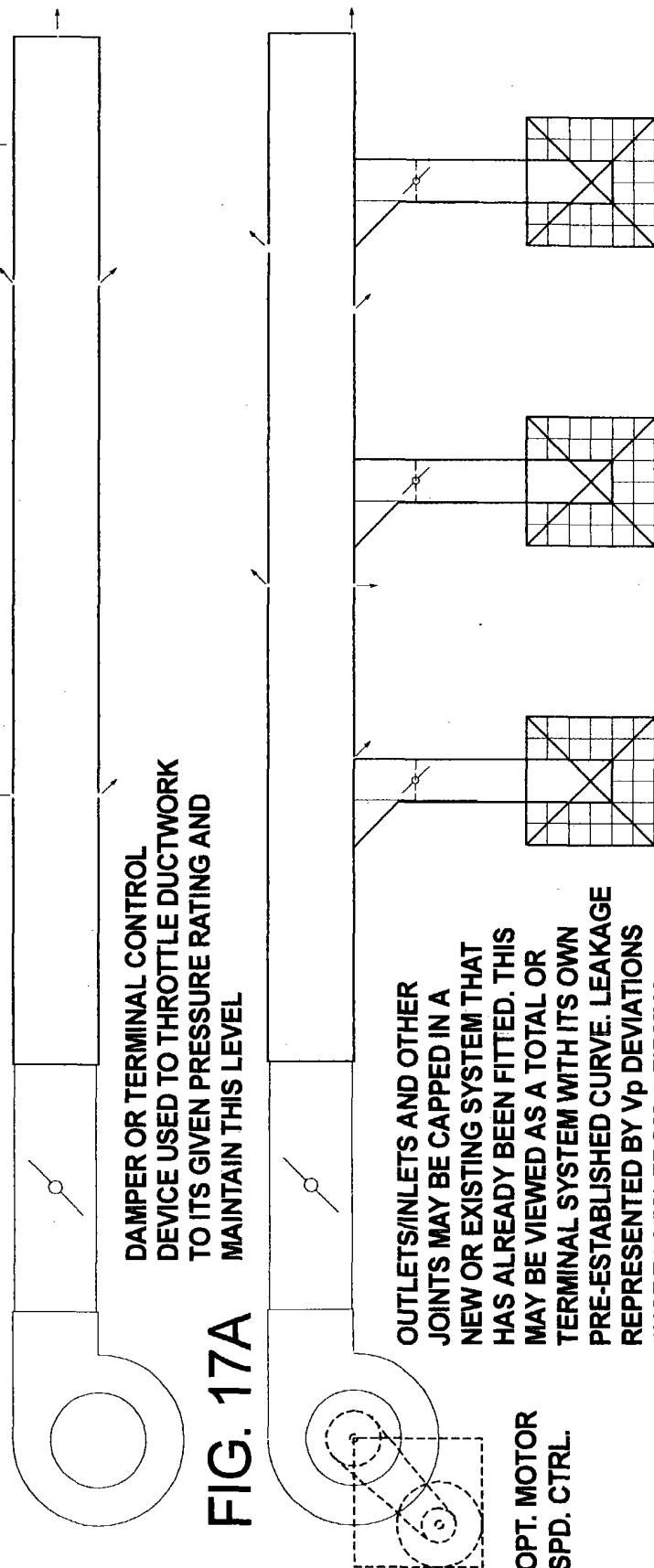
FIG. 17

DAMPER OR TERMINAL CONTROL  
DEVICE USED TO THROTTLE DUCTWORK  
TO ITS GIVEN PRESSURE RATING AND  
MAINTAIN THIS LEVEL

FIG. 17A

OUTLETS/INLETS AND OTHER  
JOINTS MAY BE CAPPED IN A  
NEW OR EXISTING SYSTEM THAT  
HAS ALREADY BEEN FITTED. THIS  
MAY BE VIEWED AS A TOTAL OR  
TERMINAL SYSTEM WITH ITS OWN  
PRE-ESTABLISHED CURVE. LEAKAGE  
REPRESENTED BY Vp DEVIATIONS  
(INCREASES) FROM A FIRMLY  
ESTABLISHED OPERATING POINT.  
SEE FIG. 12, 12A, OP DEVIATION.

OPT. MOTOR  
SPD. CTRL.



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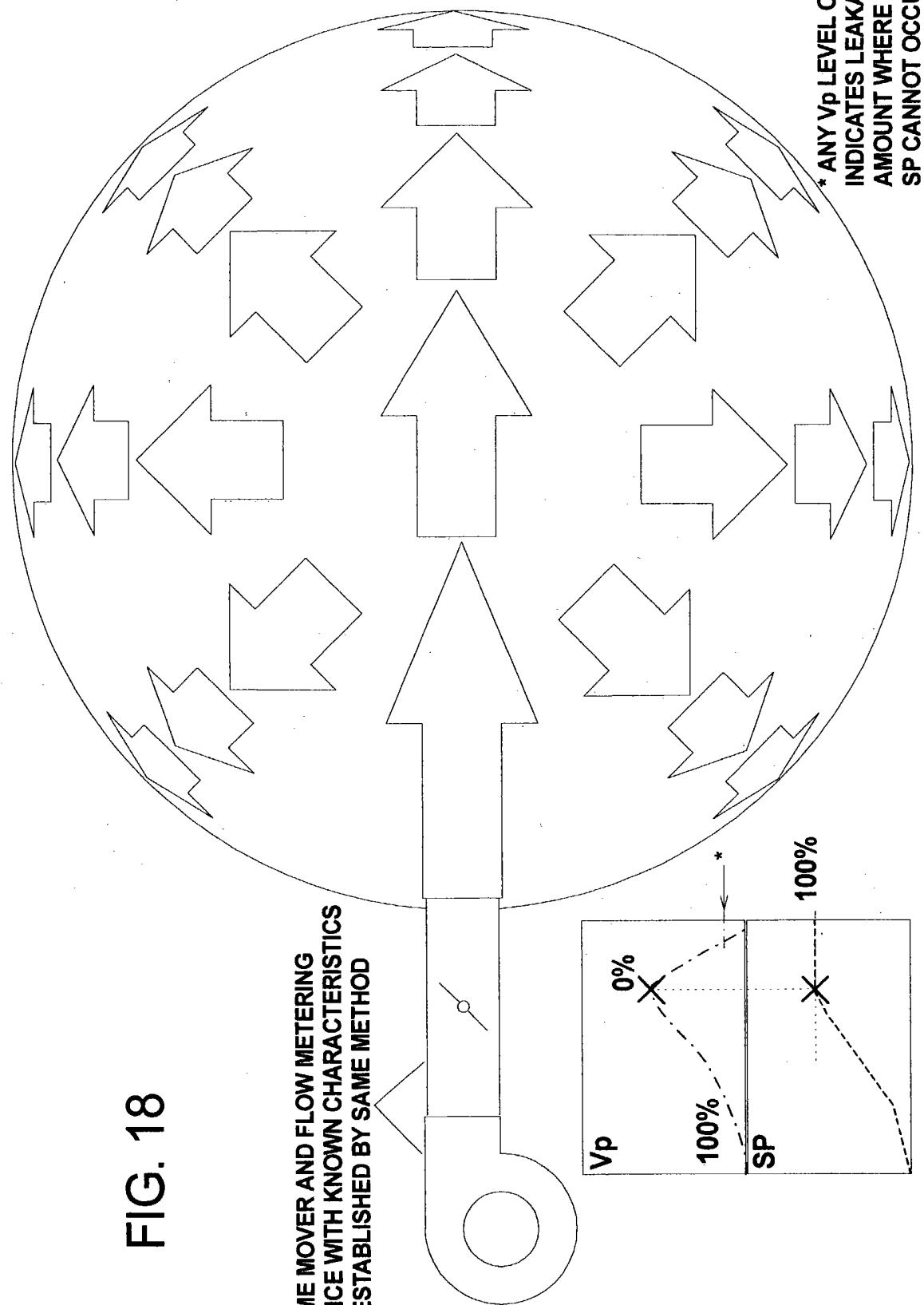
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VOLUME OF A GIVEN VESSEL OR ENCLOSURE

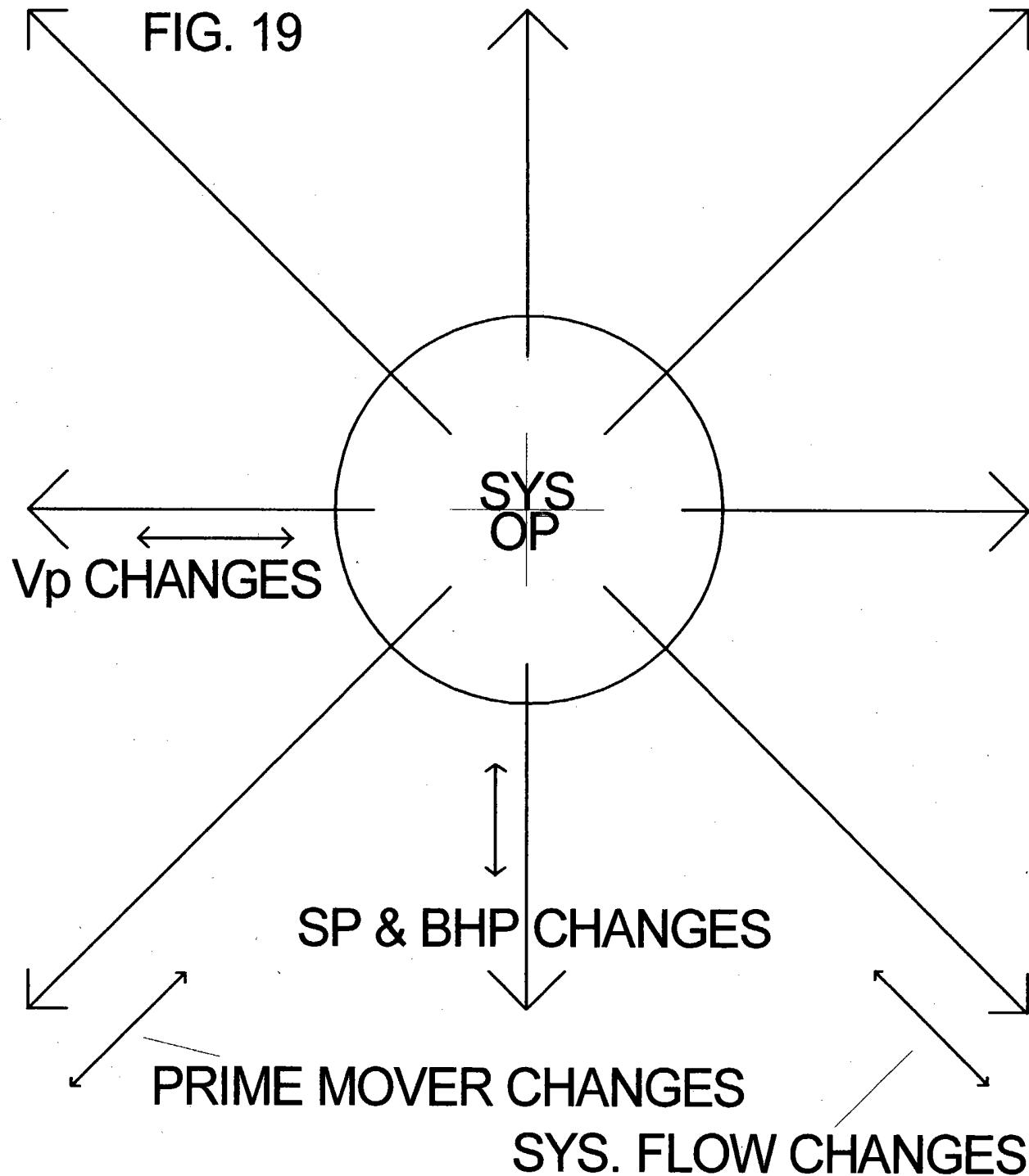
FIG. 18

PRIME MOVER AND FLOW METERING  
DEVICE WITH KNOWN CHARACTERISTICS  
AS ESTABLISHED BY SAME METHOD



## VECTORIAL DISPLAY

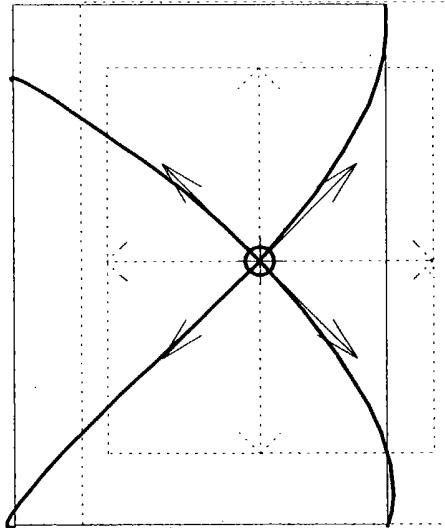
FIG. 19



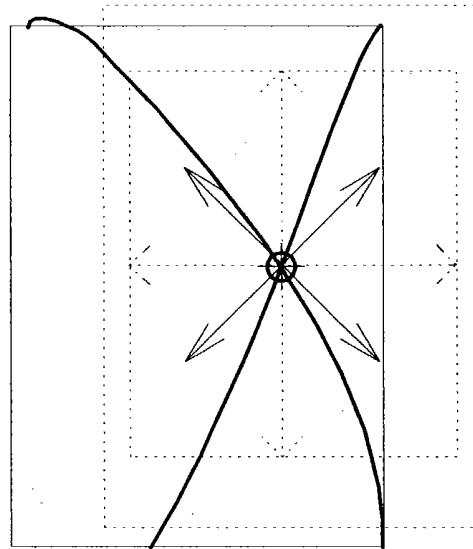
## VECTORIAL ANALYSIS - TOTAL SYSTEM TO SUB-SYSTEM

FIG. 19A

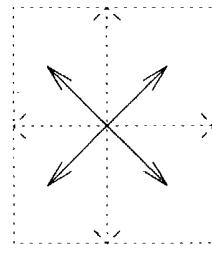
### TOTAL SYSTEM OP



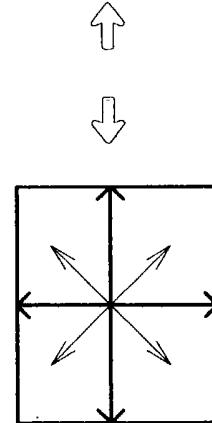
### TERMINAL BRANCH OP



SHOWN HERE, A CORRELATIVE EFFECT  
BETWEEN A TOTAL SYSTEM AND ITS SUB-  
BRANCH AS THE CHANGE IN ONE AFFECTS  
THE OTHER, EITHER ADVERSELY OR  
BENEFICIALLY. THE VECTORIAL ANALYSIS  
PROVIDES A "BARE BONES" DEPICTION OF  
EACH SPECIFIC CHANGE EFFECTED IN ONE  
OR THE OTHER SYSTEM. FOR EXAMPLE,  
THERE WAS AN X INCREASE IN BHP  
WHEN A DAMPER WAS CLOSED  
IN THE SUB-BRANCH.



SWITCH TO OR FROM MAIN  
VECTORIAL DISPLAY SCREEN  
REFER TO FIG. 9



**FIG. 20**

**SYSTEM DIVERSITY**

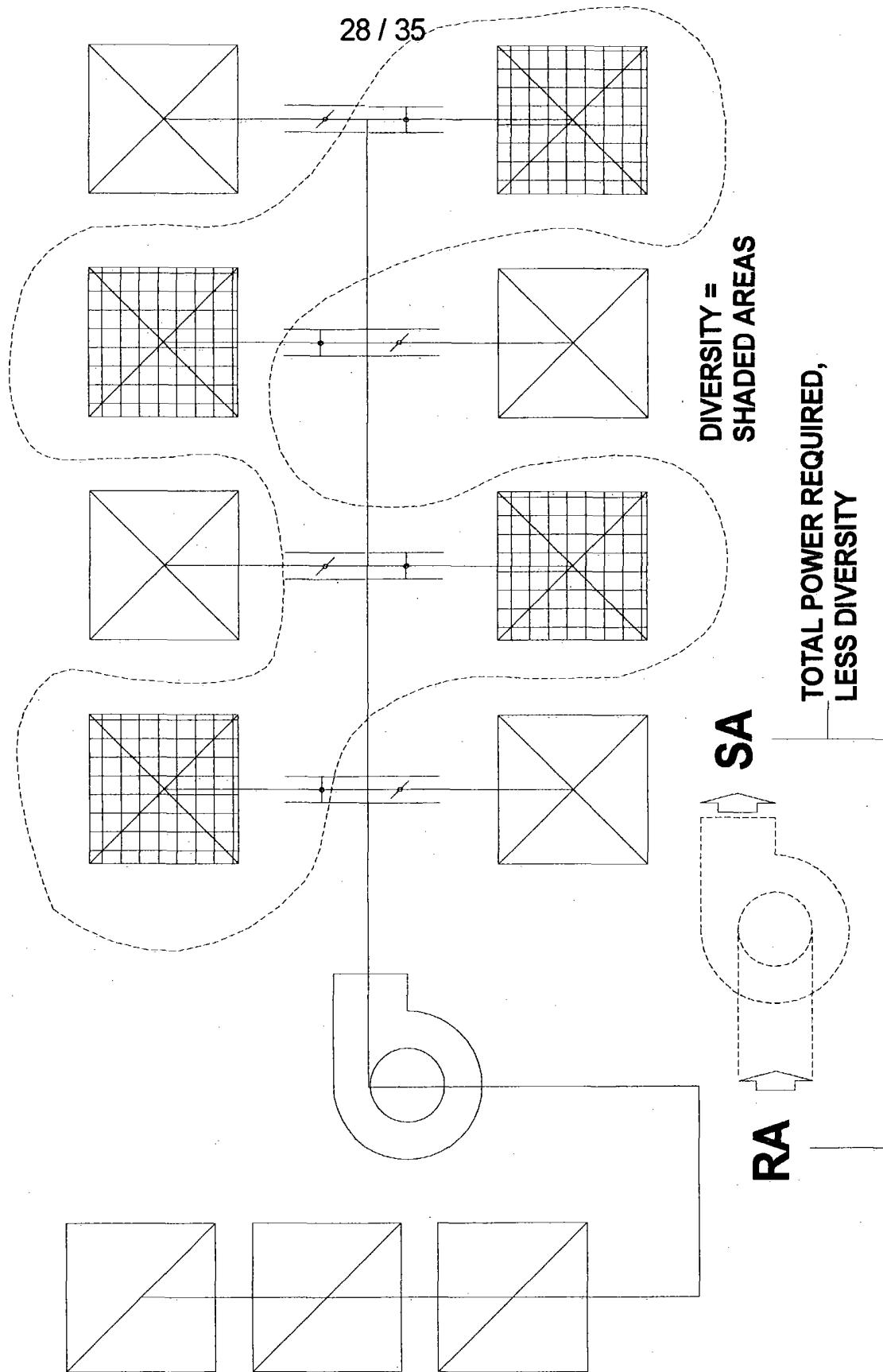


FIG. 21

MAIN MENU DISPLAY

**AIR SYSTEMS (HVAC, NON-HVAC)**  
**HYDRONIC SYSTEMS**  
**FLUIDIC SYSTEMS**  
**GASEOUS SYSTEMS**  
**MIXTURES**

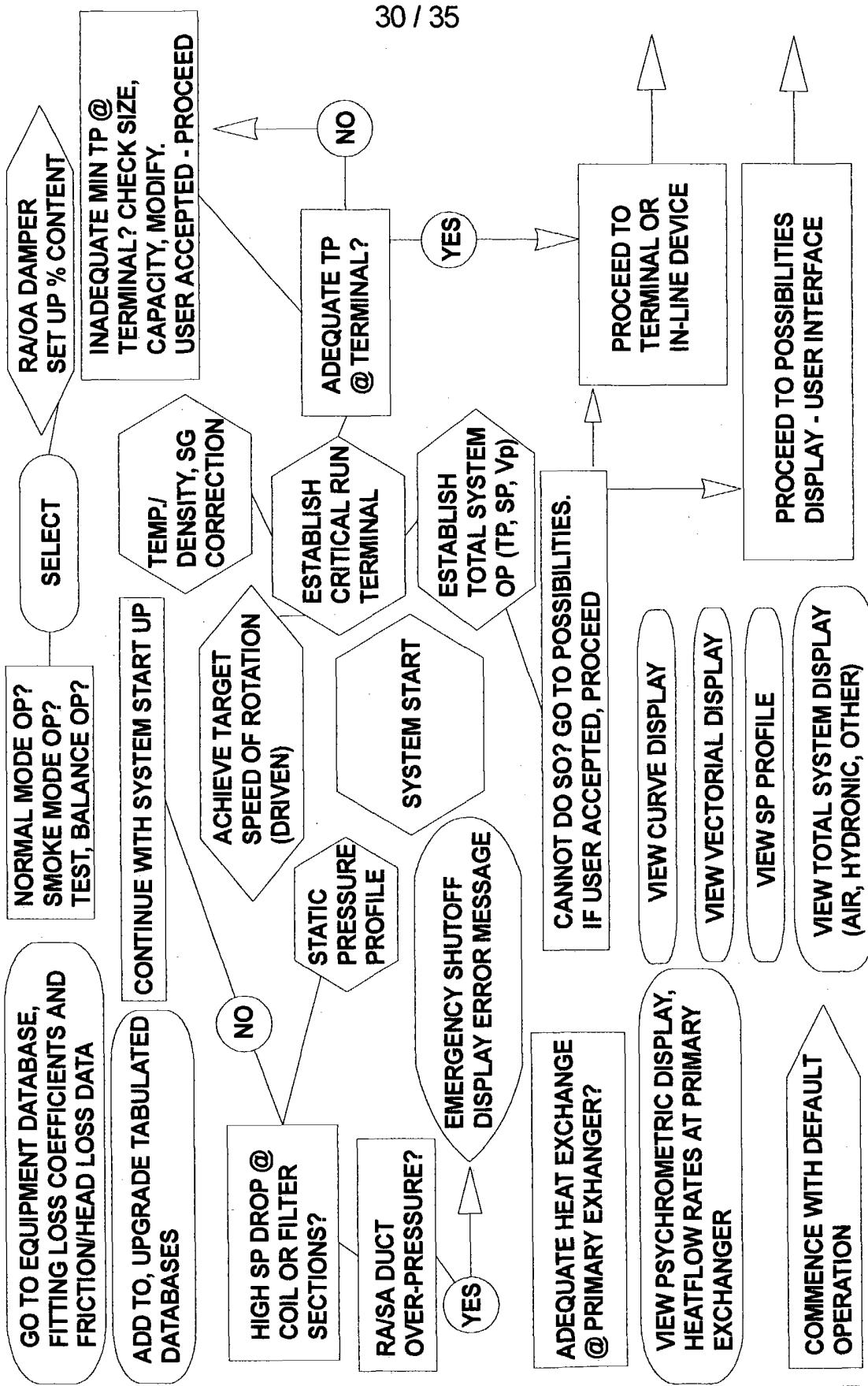
**VIEW  
MAIN  
OP CURVE  
DISPLAY**

**ENABLE  
DEFAULT  
OPERATION**

**SYSTEM  
START**

FIG. 22

SYSTEM START FLOW CHART (AIR)



## FIG. 22A SYSTEM START FLOW CHART (HYDRONICS)

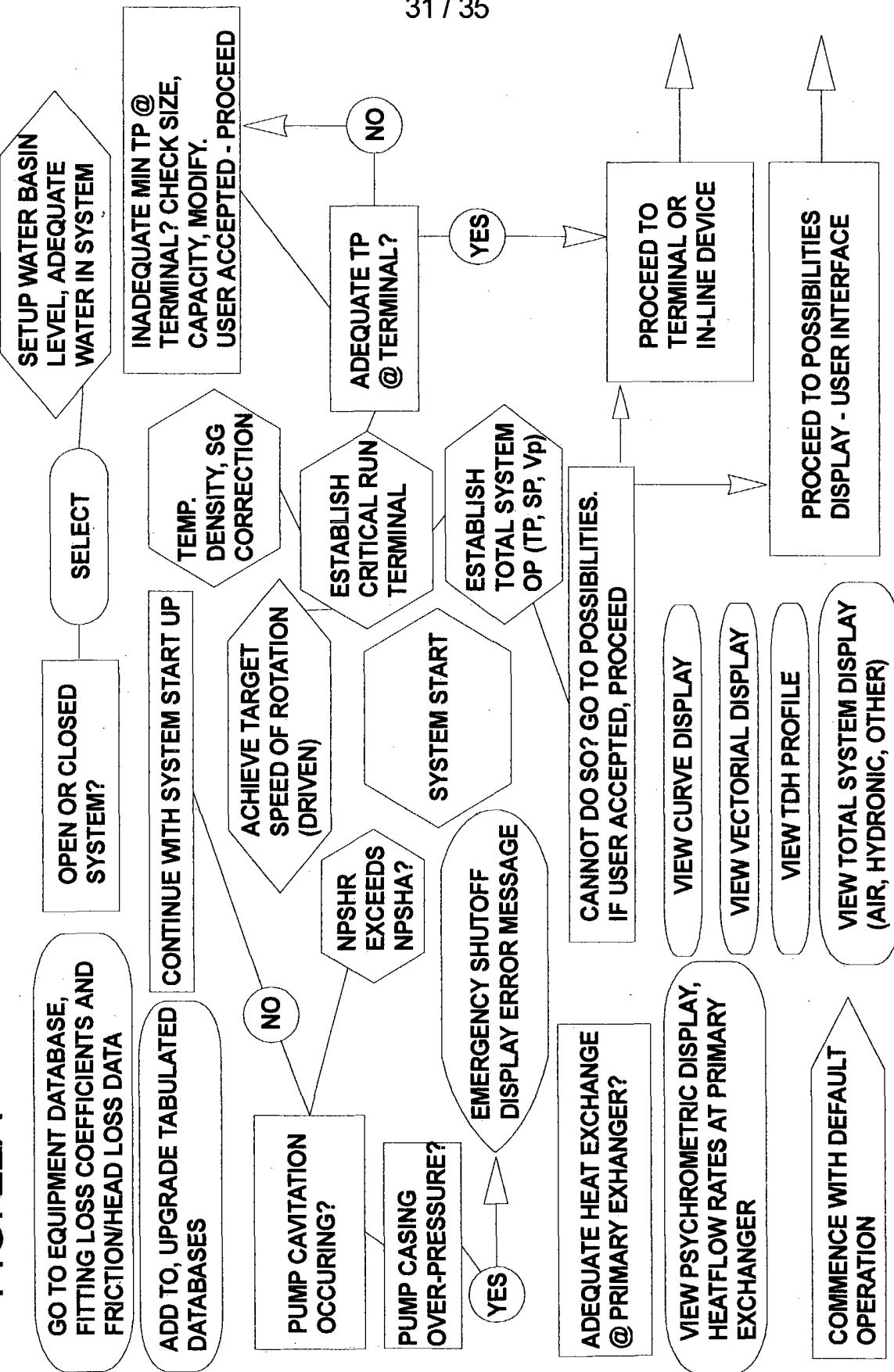
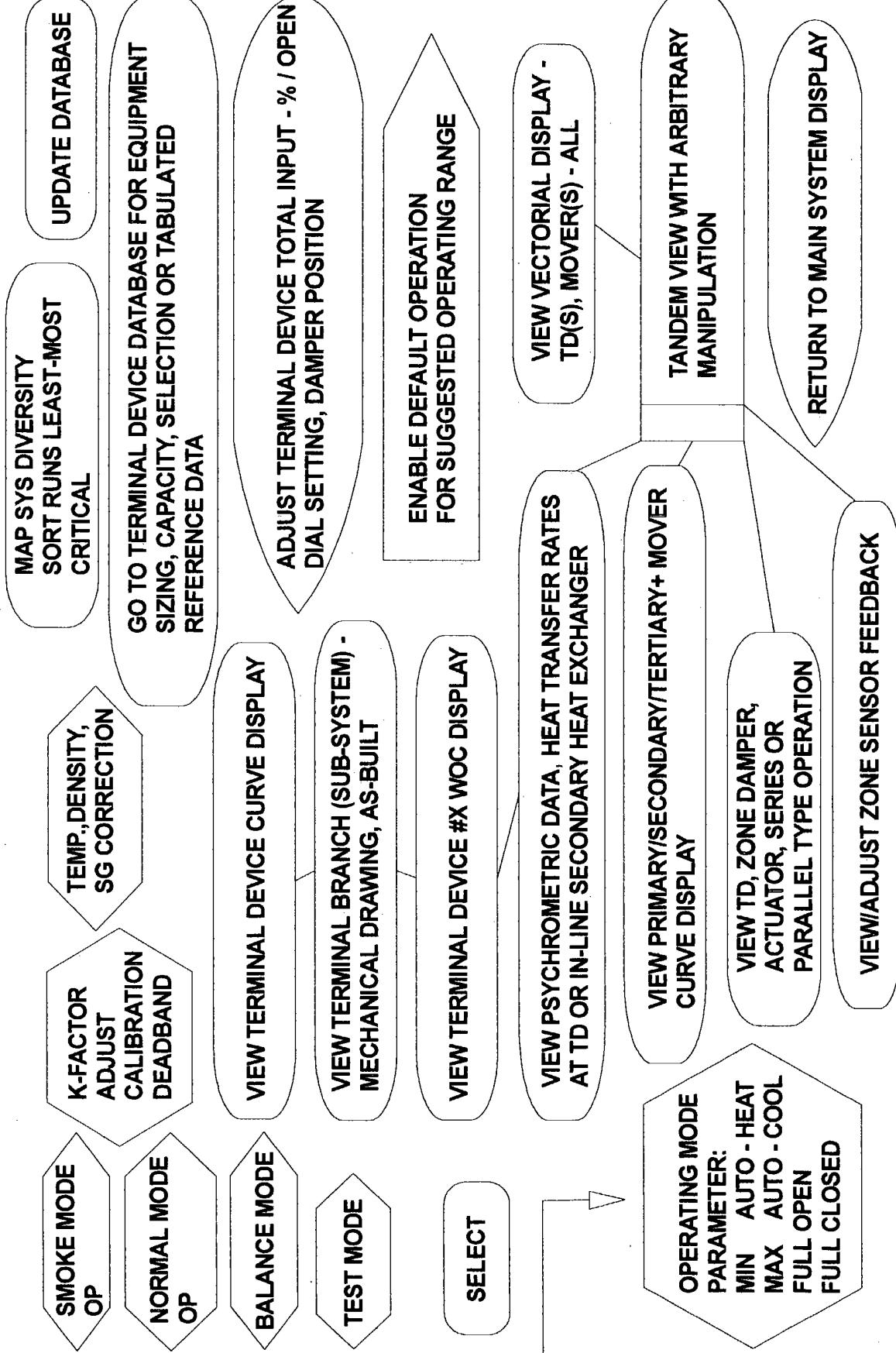


FIG. 22B

TERMINAL DEVICE FLOW CHART



## FIG. 22C POSSIBILITIES DISPLAY MENU (AIR)

VERIFY THAT THE FOLLOWING CONDITIONS HAVE BEEN MET:  
IS THE SYSTEM IN THE CORRECT MODE OF OPERATION?

### NORMAL, SMOKE, BALANCE, OR TEST MODE OF OPERATION

ARE ALL DAMPERS/VALVES/TD'S FULLY OPEN OR IN THEIR MAX DESIGN POSITIONS (LESS DIVERSITY) THROUGHOUT THE SYSTEM FOR NORMAL, SMOKE, TESTING, OR BALANCING MODE START UP?

IS MOVER ROTATION CORRECT? MAY REQUIRE PHASE CHANGE  
VERIFY THAT MOTOR/DRIVE DATA, TAG, STOCK INFO. IS CORRECT OR APPLY DEFAULT SEARCH OF DATABASE FOR SUITABLE RECOMMENDATION NEEDED TO ACHIEVE OP UNDER CURRENT AS-BUILT CONDITIONS

RA/OA, ECONOMIZER, OR OTHER INTERNAL DAMPERS SET CORRECTLY  
NORMAL OR OTHER MODE OPERATION - % RA/OA

CHECK PACKAGE HOUSING, BLOWER CABINET FOR OBSTRUCTIONS  
PROBLEM ORIGINATES FROM...?

CLEAN, REPLACE FILTERS

CLEAN COIL FINS, COIL INTERIOR  
CHECK REFRIGERANT PRESS./TEMP. IN/OUT  
CHECK EXPANSION/CONDENSATION CYCLE,  
H/I/LO CUTOUTS, EXPANSION VALVE

### SMOKE MODE OPERATION

ARE ALL SMOKE DAMPERS OPEN?  
NORMALLY CLOSED / OPEN (WITHOUT POWER)  
IS OA DAMPER FULLY OPEN? (100% OA)  
IS RA DAMPER FULLY CLOSED? (0% RA)

GO TO MOTOR/DRIVE DATABASE  
(NOT INDEPENDENT OF MOVER)

GO TO SEARCHABLE DATABASE

ADD TO, UPGRADE  
POSSIBILITY DATABASE

TRY SYSTEM RESTART

PROBLEM(S) REMAIN  
RETURN TO POSS  
INTERFACE

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INTERNAL PROBLEM:

MIXING BOX  
FILTER SECTION(S) -  
FORE / AFT OF MOVER  
COIL SECTION(S)  
BLOWER SECTION  
HUMIDIFIER / UV  
OTHER SECTION

EXTERNAL PROBLEM:

PROBLEM AT PRIME  
MOVER SUCTION,  
DISCHARGE?  
@ FLOW SENSOR  
GRID?  
@ TERMINAL OR IN-LINE  
DEVICE?  
@ SMOKE DAMPER ON  
WALL PARTITION  
DUCT SMOKE DETECTOR  
OTHER EXTERNAL  
DEVICE

TEMP/HEAT EXCHANGE  
PROBLEM

## FIG. 22D

### POSSIBILITIES DISPLAY MENU (HYDRONICS)

VERIFY THAT THE FOLLOWING CONDITIONS HAVE BEEN MET:

IS THE SYSTEM AN OPEN OR CLOSED SYSTEM?

IS THE SYSTEM IN THE CORRECT MODE OF OPERATION?

ARE ALL VALVES/TD'S FULLY OPEN OR IN THEIR MAX DESIGN POSITIONS (LESS DIVERSITY) THROUGHOUT THE SYSTEM FOR NORMAL, TESTING, OR BALANCING MODE START UP?

IS MOVER ROTATION CORRECT? MAY REQUIRE PHASE CHANGE

VERIFY THAT MOTOR/DRIVE DATA, TAG, STOCK INFO, IS CORRECT OR APPLY DEFAULT SEARCH OF DATABASE FOR SUITABLE RECOMMENDATION NEEDED TO ACHIEVE OP UNDER CURRENT AS-BUILT CONDITIONS

#### OPEN SYSTEM

DOES THE SYSTEM HAVE SUCTION LIFT, I.E., PIPING BELOW PUMP CENTERLINE?

DOES THE SYSTEM HAVE ADEQUATE NPSH?

IS WATER BASIN LEVEL BEING MAINTAINED?

IS THERE ADEQUATE MAKEUP WATER?

IS THERE ADEQUATE WATER IN THE SYSTEM AT HIGHEST POINT IN PIPING?

#### CLOSED SYSTEM

IS THERE ADEQUATE WATER IN THE SYSTEM AT HIGHEST POINT IN PIPING?

HYDRONICS TERMINAL COIL PROBLEM:

COIL CHW IN HAS CORRECT TEMP., BUT NO FLOW/TEMP. SENSED CHW OUT? AERATE COIL

GO TO MOTOR/DRIVE DATABASE  
(NOT INDEPENDENT OF MOVER)

GO TO SEARCHABLE DATABASE

ADD TO, UPGRADE  
POSSIBILITY DATABASE

TRY SYSTEM RESTART

PROBLEM(S) REMAIN  
RETURN TO POSS  
INTERFACE

PROBLEM ORIGINATES FROM...?

EXTERNAL PROBLEM:

PROBLEM AT PRIME  
MOVER SUCTION,  
DISCHARGE?  
@ FLOW SENSOR  
GRID?  
@ TERMINAL OR IN-LINE  
DEVICE?  
OTHER EXTERNAL  
DEVICE

INTERNAL PROBLEM:

PUMP CASING  
IMPELLER  
STRAINER SECTION(S)  
FORE / AFT OF MOVER  
OTHER INT. SECTION

TEMP/HEAT EXCHANGE  
PROBLEM

INDEPENDENT SYSTEM CURVES (PRESSURE / HEAD)

